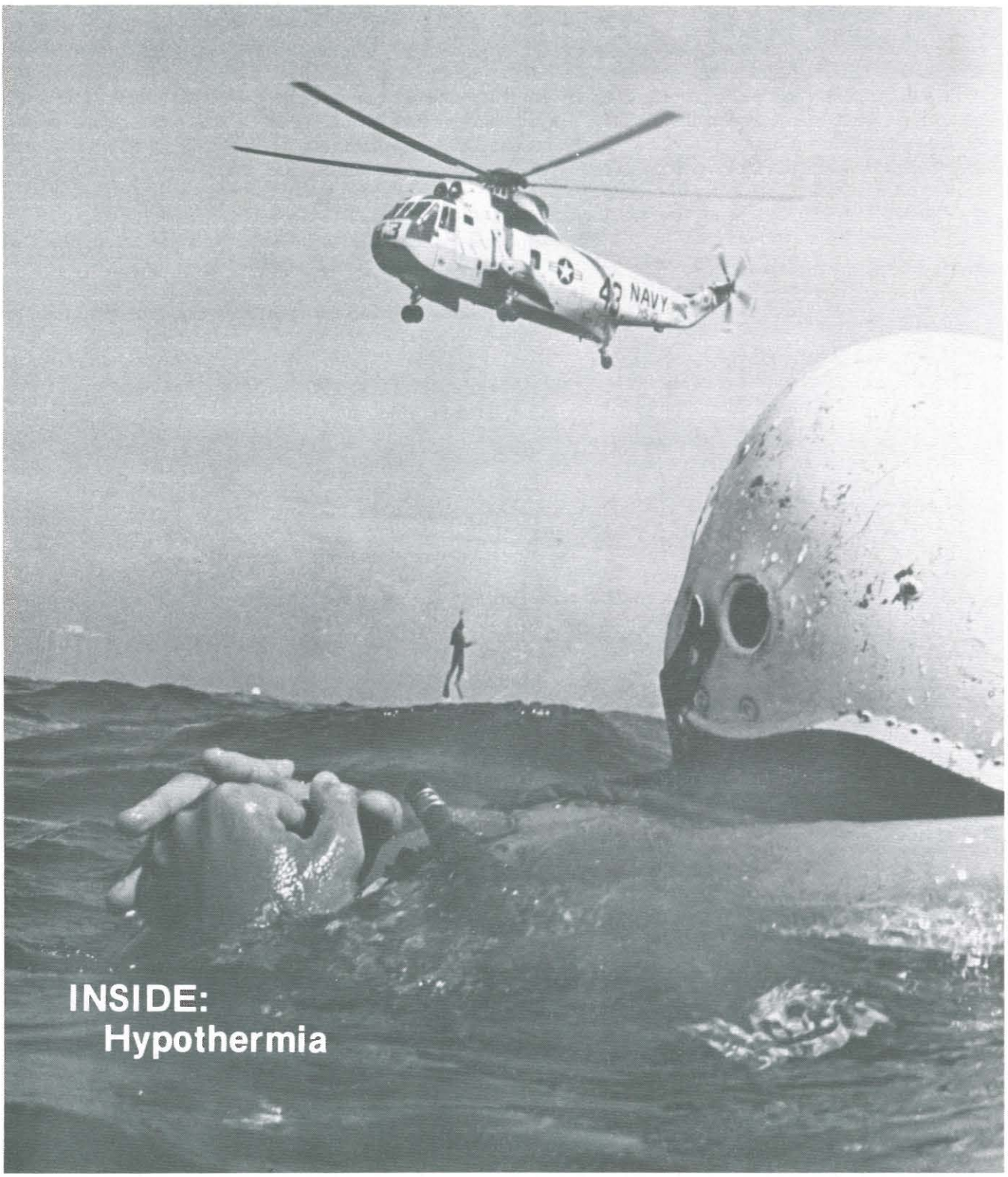
# U.S. NAVY MEDICINE

March 1982




INSIDE:
Hypothermia

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NAVMED P-5088

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Vol. 73, No. 3
March 1982



**COVER:** A pilot awaits rescue following a simulated ditching in the Pacific. Immersion can lead to hypothermia, a condition that may occur in any environment where body temperature drops significantly. Part one of a series on its physiology and treatment begins on page 6. Photo by JOC Warren Grass.

# A Mass Casualty Drill

In they came, crushed, burned, and blasted—the inevitable by-products of conflicting interests between two opposing groups of men and their machines of war.

As each ambulance arrived, teams of stretcher-bearers swiftly unloaded their blood-spattered human cargoes and shuttled them to the admission and sorting tent, where the waiting triage officer assigned them a category and priority: immediate—those requiring immediate surgery, delayed—those who require some care, minimal—those needing very little care, and expectant—those with little chance of surviving regardless of what care is given them.

The 60-bed field hospital turned into a hive of activity as this latest wave of casualties was distributed throughout the wards of the camp. The vital and frantic mission of saving and sustaining lives was undertaken once again.

Fortunately, in this instance, the only injuries treated were of the simulated rubber variety, and the 60-bed field hospital from B Company, 3rd Medical Battalion, 3rd Force Service Support Group, was merely on a training exercise near Camp Hansen, Okinawa. Merely, that is, until one considers that this kind of training might save lives should the possibility of war become reality.

During the drill, corpsmen, surgeons, and nurses faced a wide variety of "casualties" with the kinds of wounds that might be encountered in combat.

"We had everything from traumatic amputations to eviscerated bowels, minor lacerations, crush wounds, blindings, burns, psych patients—the whole sordid affair," said HM2 Terry Sawhill. "On the whole, I think we handled the drill professionally and did really well."

On hand and participating in the drill was HMCM Stephen Brown, Force Master Chief of the Navy Hospital Corps, and many other senior corpsmen as well. All were impressed with what they observed, according to LTJG Dallas Bisignano, officer in charge of the field hospital.

Bisignano described 3rd Medical Battalion (one of three in the Fleet Marine Force) as being composed of five medical companies, each with its own 60-bed field hospital. Additionally, the battalion has a hospital company capable of fielding 200 beds, and a headquarters and service company to deal with the administrative details.

"The mission of the 60-bed field hospital is emergency life-giving and life-sustaining surgery, temporary hospitalization, and evacuation. We have a surgical platoon, two evacuation platoons, and a services section in the company," said Bisignano. "Though it looks austere," he said, gesturing at the surrounding green canvas tents, "we can perform the same life-saving care as a civilian hospital. The most noticeable difference is that we don't have walls. We're mobile."

He noted that they were never meant to provide care beyond life-saving and sustaining. "You could say that we're the second stage in the process. The first stage is the line corpsman who patches the casualty up enough to get him here alive. We perform the necessary surgery to take his life out of danger and then sustain him until he's ready to be

*LCDR Elizabeth Hart, Director of Nursing Education for the 3rd Medical Battalion, supervises the distribution of incoming casualties in her capacity as "triage officer."*

back to duty or is well enough to be transported to a hospital ship or fixed medical facility, where more definitive care can be provided," said Bisignano.

The field hospital is capable of taking and developing x-rays and has a laboratory for testing and analysis, its own pharmacy which stocks mostly pain-killers and antibiotics to deal with the pain and infection, two operating rooms, a blood bank, acute and general care wards, and a morgue.

Bisignano said that this particular 60-bed field hospital training exercise carries a 15-day stock of medical supplies based on an estimated 50 casualties per day, noting that that amount would require 15 tractor-trailers to move.

"We move behind the fighting force, but we can only move a portion at a time. Because we're doubled-up in most areas (operating rooms, wards, etc.) we can move and still provide good medical care," insisted Bisignano.

According to LCDR Paul Ammons, 3rd Medical Battalion's S-3 officer, the exercise which occurred recently near Camp Hansen's Gate 2 was primarily designed to ". . . doctrinally test a self-supporting, reinforced medical company in order to review comprehensively the company table of organization and table of equipment, and to list the support required from sources external to the battalion."

In order to accomplish the mission, a field messing facility was set up to feed the entire battalion for 3 days. A field shower was also constructed and used and power and water consumption studies were conducted on both facilties.

"The secondary mission was to conduct mass casualty drills in support of the CREATE program," said Ammons. The Combat Readiness Education And Training Experiences is a 12-week advanced medical training program through which 3rd Medical Battalion hospital corpsmen go.

In the program, corpsmen spend 5 weeks studying in the classroom, 4 weeks at Camp Kuwae, Okinawa, working and learning in their individual areas of medical skill, and top off the training with 3 weeks in a field environment. Following this mass casualty drill, the latest crop of CREATE trainees graduated with honors.

"In all areas," said Ammons, "the exercise was very much a success. We accomplished everything we set out to do."

—Story and photo by CPL Dave Robertson, USMC □

# Comment From the Force Master Chief

I recently returned from West Pac, where I had the opportunity to observe and take part in a field exercise of the 3rd Medical Battalion at Camp Hansen, Okinawa. Pride and professionalism was very evident as the battalion's personnel carried out their jobs as part of the Medical Department team. Special congratulations to LCDR Elizabeth Hart, NC, USN, and the staff officers and petty officers for their fine leadership.

We are not out of the woods yet on the issue of combat medical readiness, but anyone who had the chance to observe what I did at Camp Hansen would know we are well on the way. The majority of our Medical Department enlisted have come alive and the dramatic shift in morale and attitude is evident. Pride and professionalism is here to stay.

*HMCM S.W. Brown, Master Chief of the Force, inspects the operating facilities.*

# In-Barracks Screening: An Alternative Approach to Sick Call

LCDR John R. Heltsley, MSC, USN

In recent years the real value of Department of Defense health care delivery resources has decreased while, at the same time, the beneficiary population and services provided have continued to escalate. In order to do more with less, each health care provider must be concerned with developing an effective and efficient means of delivering care to all eligible beneficiaries.

The typical system that provides outpatient medical care to the active duty population is sick call. This system, designed around the early morning clinical visit, allows military members evaluation and treatment prior to beginning their normal duty day. The impetus for the continued use of this treatment modality has been the expedient evaluation of an individual's illness, the appropriate treatment for that illness, and the expeditious return of the individual to full duty status. (*1*) At NRMC Orlando, FL, the active duty patient receives this type of outpatient care at the NRMC Annex, Naval Training Center.

The Annex is specifically tasked with providing and coordinating all health related services to recruit patients as well as giving specialized physical examinations to all other active duty personnel assigned to the Naval Training Center. (*2*)

The greater portion of active duty patients seeking outpatient medical treatment arrive at the NRMC Annex during the first hour of the duty day. The facility is often overwhelmed and an intensive queuing problem results. This observation has been further substantiated through studies conducted by the Army. (*3*)

The loss of time by waiting has the greatest impact on the mission of the military. It appeared that under the existing system, an inordinate amount of both provider and recruit time was being lost. The Annex, therefore initiated a trial in-barracks medical screening program to alleviate the crunch encountered during routine sick call. The program was instituted on 21 Jan 1980.

## In-Barracks Medical Screening

The program's intent was to measure the impact of sick call waiting times on the Annex providers and the recruit population. The initial test required that two recruit divisions, each composed of 10 companies of approximately 80 recruits per company, be randomly chosen as a test and control population. It also required staffing for the project and a finite time limit for the test. An 8-week test period was chosen because that would allow at least one company in each of the divisions to complete their 8-week recruit training. Division 8 became the test division and Division 5, the control division. The screening program was staffed by two clinical assistants and one independent duty qualified hospital corpsman. The data collection phase of the pilot project appears in Table 1.

## Analysis Test Data

The test data show a positive correlation between the mean noneffective times of the recruits in the test division and the recruits seen in the NRMC Annex. The in-barracks screened recruit averaged less waiting time for treatment and, as such, less training time was lost when compared to the control division. This disparity in noneffective time is even more significant when considering that the recruit in the control division has an additional 15 to 20 minutes of lost time by walking to and from the NRMC Annex.

During the conception stage of the screening program, available Army data was used for base guidelines. It was noted that in a similar type of study the Army's disposition rate averaged approximately 24 percent for over-the-counter medications and 40 percent for treatment by a clinical assistant. (*4*) This 64 percent screen-out rate provided the pilot program with acceptable guidelines.

In-barracks screening revealed that only 15.4 percent of the test division recruits were referred to the Annex, a screen-out rate of 85 percent.

LCDR Heltsley is presently Director, Administrative Services at the Naval Regional Medical Clinic, Quantico, VA 22134.

**TABLE 1. Eight-Week Test Data**
21 Jan-14 March 1980

| Week | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Totals |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Test Group—Division 8 | | | | | |
| N (Patients) | 164 | 173 | 249 | 259 | 202 | 166 | 216 | 249 | 1678 |
| Mean Noneffective Time (in minutes) | 26.2 | 15.1 | 13.2 | 13.1 | 16.3 | 11.4 | 11.8 | 11.2 | 14.78 |
| Total Referrals | 21 | 30 | 48 | 29 | 30 | 18 | 38 | 45 | 259 |
| Percent Referrals | 12.8 | 17.3 | 19.3 | 11.1 | 14.9 | 10.8 | 17.6 | 18.1 | 15.4 |
| Percent of the Total Population Seen/Week | 28.5 | 26.7 | 24.8 | 26.6 | 20.6 | 17.0 | 22.5 | 25.7 | 24.1 |
| | | | | Control Group—Division 5 | | | | | |
| N (Patients) | 214 | 261 | 275 | 310 | 281 | 217 | 242 | 317 | 2117 |
| Mean Noneffective | 115.3 | 99.0 | 84.7 | 96.4 | 88.2 | 94.4 | 97.5 | 91.2 | 95.83 |

**Pharmaceutical costs**

Due to inflation, pharmaceutical costs have been continually rising and have become one of the highest users of medical financial resources. In our study, it seemed appropriate to review cost of over-the-counter medications that would be employed in the in-barracks program to determine if the program could reduce the pharmacy/prescription cost at the Annex.

A strict accounting of each prescription was kept to isolate accurately the costs of pharmaceuticals used in the Division 8 program. Each week, a report showed the total dollar amount spent on medications for that week, the average prescription cost, and an evaluation of these costs based on the number of recruits that actually received drugs, rather than on the number seen in the sick call environment. Table 2 shows the total weekly pharmaceutical cost, the average weekly prescription cost, and the final average per patient cost for the Division 8 program.

**TABLE 2. Weekly Pharmaceutical Costs**

| Test Week | Total Prescriptions Filled | Total Costs | Average Prescription Costs |
|---|---|---|---|
| | Division 8 | | |
| 1 | 165 | $57.14 | $0.345 |
| 2 | 173 | 56.20 | .325 |
| 3 | 154 | 67.73 | .440 |
| 4 | 230 | 65.91 | .286 |
| 5 | 170 | 44.91 | .264 |
| 6 | 148 | 50.37 | .340 |
| 7 | 180 | 66.42 | .370 |
| 8 | 247 | 76.45 | .310 |
| | 1,467 | | $0.335 Average |

Cost Formal
1678 patients seen
1467 prescriptions filled
.88 prescriptions/patient

Average Cost Per Patient
.88 X .335 = $0.295

To be able to compare the Division 8 pharmaceutical costs to those of the Annex, a 2-week concurrent pharmacy study was undertaken. To keep the total number (Ns) of both studies as close as possible, a 2-week test was conducted at the Annex. During this period there were 1,100 prescriptions filled (compared with 1,467 in the screening program) for the male recruit population. This study insured that only male recruit prescriptions were evaluated in order to keep the two data bases as close as possible.

One problem encountered during this study was the inability of an available methodology to subtract the 15 percent of the Division 8 recruits who were referred to the Annex for further evaluation and treatment. Although this inability will cause the pricing data of pharmaceuticals to be skewed slightly in the direction of higher Annex costs, it is felt that with an N of more than 1,000, the total cost skew would be extremely small.

The final results of the study revealed 1,110 prescriptions filled, a total cost of $1,082.43, and an average per patient cost of $0.9821. This is approximately 200 percent greater than the in-barracks program. This dramatic increase in the pharmaceutical costs may be due to the Annex providers (i.e., higher skill levels) using more expensive chemotherapeutic agents.

### Health Record Maintenance

In the design stage of the in-barracks program, one of the major concerns on the part of the providers was how to incorporate the patients' daily visits to the program into the present system of health record maintenance. Several methods were discussed and reviewed, and the final determination was made that the hospital corpsmen in the test division must be responsible for the maintenance of their divisional health records. This system was chosen over the other methods for a variety of reasons:

- The screening hospital corpsmen should be able to provide a higher quality of health care to their patients because they would have immediate access to the treatment records; they would know what treatment had been rendered during the patient's previous visit.
- There is the advantage of immediate transcription of health care services provided, rather than transcription at a later date as is now the case in the Annex. This would eliminate the loss of sick call transcriptions and the inundation of the individuals health record with SF600s.
- A higher quality of health record for the field activities was expected. The hospital corpsmen in the test division were tasked with insuring that each recruit's health record was collated in the correct order prior to the transfer of that individual.
- It was expected that the move of the health records into the divisional setting would promote more attention to detail in the maintenance of the health record since the corpsmen would have a proprietary interest in maintaining their own records.

During the 8-week test project a routine was established for the maintenance of records. The results of any type of procedure completed on a Division 8 recruit by the Annex were returned to the division within a 24-hour period. To check the program's effectiveness, there was a random inspection of 200 health records. In the test division there were only 11 records with any type of error or a 0.05 percent error rate. The Annex records revealed 55 errors or an error rate of 0.275 percent.

### Results

This study provided an analysis of recruit noneffective time and demonstrated, on an 8-week average, that recruits were returned to duty in about one-sixth the time of the present system, thus reducing the queuing problem at the Annex. The test also revealed that pharmaceutical costs were reduced by more than two-thirds, total visits to sick call were reduced by 20 percent, and that approximately 85 percent of the recruits seen at the in-barracks screening program were returned to duty without requiring the services of either a physician or physician's assistant. None of these required any medications other than over-the-counter preparations.

The productivity of the patient and the provider appears to have been increased during the test, and the job satisfaction and morale of personnel at the Annex improved. Other areas that showed positive correlation were: improved communications between the Recruit Training Command, the Naval Regional Medical Center, the Annex, and between the recruit company commanders and the individual health care providers.(5) There also was improved use and maintenance of health records. Above all, there was a clear demonstration that the in-barracks screening program improved the quality of health care provided to individual recruits.

The test phase of the screening program ended in March 1980. However, it continued to function until July 1980, when it was expanded to include the entire recruit population.

### References


1. Wolcott BW, Steineker RE: The use of in-barracks screeners to improve military sick call. *Milit Med*, p 99, February 1979.
2. NRMC Orlando *Organization Manual.* NRMC Orlando Instruction 5450.1, p 56, December 1975.
3. Wolcott: The use of in-barracks screeners to improve military sick call, pp 99-100.
4. Ibid., pp 99-100.
5. Further data on these areas are available from the author. □

# Hypothermia

CDR Donald C. Arthur, MC, USN

## Characteristics and Mechanisms

*On 13 Jan 1982 in Washington, DC, an Air Florida 737 struck the 14th Street Bridge and plunged into the Potomac River. Six passengers survived the impact but only five lived through a harrowing ordeal in the icy water before being rescued. Of the survivors, several suffered broken bones and other injuries; most were in shock, one only moments away from death. All were victims of hypothermia, a condition in which body temperature decreases rapidly, limbs become numb, the victim's life systems begin shutting down, and cardiac and respiratory failure eventually occur.*

*That hypothermia could occur in an icy river in the midst of a January snowstorm is not surprising. In fact, hundreds of winter recreationists die each year from this condition on mountain slopes, in thin-iced skating ponds, or after being dunked in the same kind of water the Air Florida passengers experienced. What is not well known is that hypothermia can also occur on cloudless, springlike days when the elements seem too benign to threaten any form of life.*

*Take the case of eight Marines and a Navy companion who attempted to cross the Potomac in a 25-foot canoe on an unseasonably warm day in March 1968. The men were members of the same physical fitness class at the Quantico Marine Base. They were in top physical condition, were good swimmers, and all perished before reaching the nearby shore.*

*The fate of these hypothermia victims might have been predictable. Although the air temperature was in the 50s, the water that sapped body heat and paralyzed their limbs was in the 30s.*

*Hypothermia need not be associated with frigid water. It is a leading killer of the elderly and infirm and can occur under any conditions where normal body temperature drops significantly.*

*The following three-part series is based on an educational manual prepared and distributed by the Naval Submarine Medical Research Laboratory, Groton, CT. The manual was originally directed toward fleet duty corpsmen accompanying personnel performing operations in cold water or cold weather. However, the information it contains is applicable to any environment or situation where hypothermia is a clear and present danger.* —JKH

Hypothermia is defined as an abnormal lowering of body core temperature (the internal temperature of the body; that of the vital organs), the effects of which are in a gradient from only a mild decrease in motor and cognitive functions to the severe reactions of cardiac and respiratory failure. The purpose of this series is to serve as an educational guide for Navy corpsmen who would have occasion to encounter hypothermia as they accompany personnel who will be subject to immersion in cold water and exposed to cold weather. Diving operations obviously present high risk. The diver and also the ancillary personnel must be considered. This includes the tenders, supervisors, and stand-by divers. As reported by the 1980 International Hypothermia Conference and Workshop at the University of Rhode Island, the past 8 years have seen 917 Scuba fatalities, one-third in water of less than 65°F and, of those, one-quarter were probably victims of hypothermia.

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"Can't people tell when they're getting cold?" one might ask. Yes, but when one is diving in cold water, one expects to feel cold. Yet this is not a quantitative measure of body heat loss and the effects of hypothermia are insidious, not readily detectible by the casual observer. The early effects are sometimes subtle. In addition to early cognitive functional decrements, there is a dramatic decrease in motor function due to the compensatory mechanism of vasoconstriction seen in hypothermia. Hypothermia also increases susceptibility to decompression sickness, carbon dioxide toxicity (partially due to the decreased effectiveness of the carbon dioxide scrubbers in cold water), and oxygen toxicity.

Heat is extracted from the body by the colder environment. If metabolic heat production can keep pace with external losses, there is homeostasis. If it cannot, then shivering and vasoconstriction are the next responses. However, they are only stop-gap measures as body energy is quickly drained with continued exposure. As will be discussed, body heat is gained through production of metabolic heat as well as shivering, is lost through conduction, evaporation, convection, and radiation, and is conserved by vasoconstriction and protective clothing.

Interestingly, water at 80°F causes the same heat loss as 42°F air. The magic temperature for water is 92°F. This is the temperature at which one can remain in homeostasis; heat production keeps pace with environmental heat loss. Below 92°F, the body will eventually begin to lose more heat than it can produce. Exercise will increase heat production but, unfortunately, will also increase heat loss and at a greater rate. One can maintain body heat in 60°F water with maximum shivering but only for a short period until energy stores are depleted.

Consider for a moment a common fleet scenario of a diver performing cold water diving operations. He surfaces after breathing cold gases in cold water and working hard on the bottom. He's cold. During his surface interval he takes a hot shower and drinks some hot coffee. He feels better now and is ready for another dive. On the second dive his performance is less than earlier that same day; he has trouble operating simple tools, forgets items on a checklist, his speech becomes garbled, and he is brought to the surface by his tenders with thoughts of carbon dioxide buildup or other common diving malady. There is no thought of hypothermia. What might have really happened? The diver became chilled on the first dive, invoking vasoconstriction of his extremities as the primary defense mechanism against hypothermia. This allowed his extremities to chill while preserving the core temperature. While on the surface, however, the hot shower acted to break the vasoconstriction and produce vasodilation. This has two effects, first to allow warm blood in the core to be cooled by the relatively cold extremities and, secondly, the diver will be vasodilated when reentering the water, thereby becoming colder quicker. The result is a hypothermic diver manifesting decreased mental and physical functioning without himself realizing it.

The effects of hypothermia vary with the individual, depending, in part, on body build, body fat content, state of nutrition, physical conditioning, and anaerobic capacity. An understanding of the body's normal thermoregulatory mechanisms of heat production and conservation, the subtle signs and symptoms of hypothermia, treatment modalities, and methods of prevention are essential.

## Normal Thermoregulatory Mechanisms

The temperature of the body remains nearly constant with only 1°F diurnal variation. Heat is continually being produced as a by-product of normal metabolism and is constantly being lost to the surroundings. When these two processes occur at the same rate, the body is said to be in thermal equilibrium. Factors which affect heat production are the basal metabolic rate, the effects of hormones, exercise, sympathetic nervous system effects, and the direct effect of temperature on cellular metabolism. Factors involved in heat loss are radiation, conduction, evaporation/convection, and conduction/convection. We shall examine each of these factors individually as they affect normal temperature homeostasis as well as their central regulation.

**Heat Production.** Metabolism is simply the conversion of the raw materials contained in food to useful materials and energy, producing heat as a by-product. The metabolic rate determines the amount of heat produced. Only about 25 percent of the energy stored in food is eventually available for use by the body, the remaining 75 percent becomes heat. The basal metabolic rate (BMR) is the lowest metabolic rate of a given individual at rest and is specific for each person. The metabolic rate can, however, be increased by a number of factors.

Exercise causes the most dramatic effect on metabolic rate. Short bursts of maximal muscle contractions can liberate as much as 100 times the normal amount of heat. Overall, maximal muscle exercise can increase the rate of heat production to 50 times normal for only a few seconds or 20 times normal for several minutes. Jumping ahead, one can readily see that shivering, or maximum muscle activity, can rapidly deplete the body of available energy stores. If shivering were the only heat producing mechanism standing between normal thermal homeostasis and hypothermia, then when exhaustion ensued, the individual's heat loss would not be compensated for and severe hypothermia would result.

Age is also a factor in basal metabolic rate, but mentioned here only for general information since the BMR is relatively constant between the ages of 18 and 50. The BMR is highest for the very young and lowest for the aged.

The thyroid gland is the metabolic carburetor for the body. When it maximally secretes the hormone thyroxine, the metabolic rate can be increased up to 100 times the basal rate. In contrast, loss of thyroid function would decrease the metabolic rate by only one-half. This illustrates the basic function of the thyroid gland, to increase the metabolic rate in response to body needs. (This makes sense since the basal metabolic rate is supposed to be the lowest metabolic rate allowing normal functioning at rest.) Thyroxine is one of the hormones released in response to cold as well as other stresses. There is, however, a lag time between stimulus and secretion and between secretion and the eventual effect of thyroxine on the metabolic rate.

Sympathetic nervous system stimulation occurs as a result of exposure to cold. This causes the release of other metabolically active hormones such as epinephrine, norepinephrine, and growth hormone which can collectively increase the metabolic rate as much as 100 percent. Although this effect seems small in comparison with the others above, the sympathetic nervous system also controls vascular tone which, as will be explained later, is the most important mechanism for preserving whatever heat is produced in the cold environment.

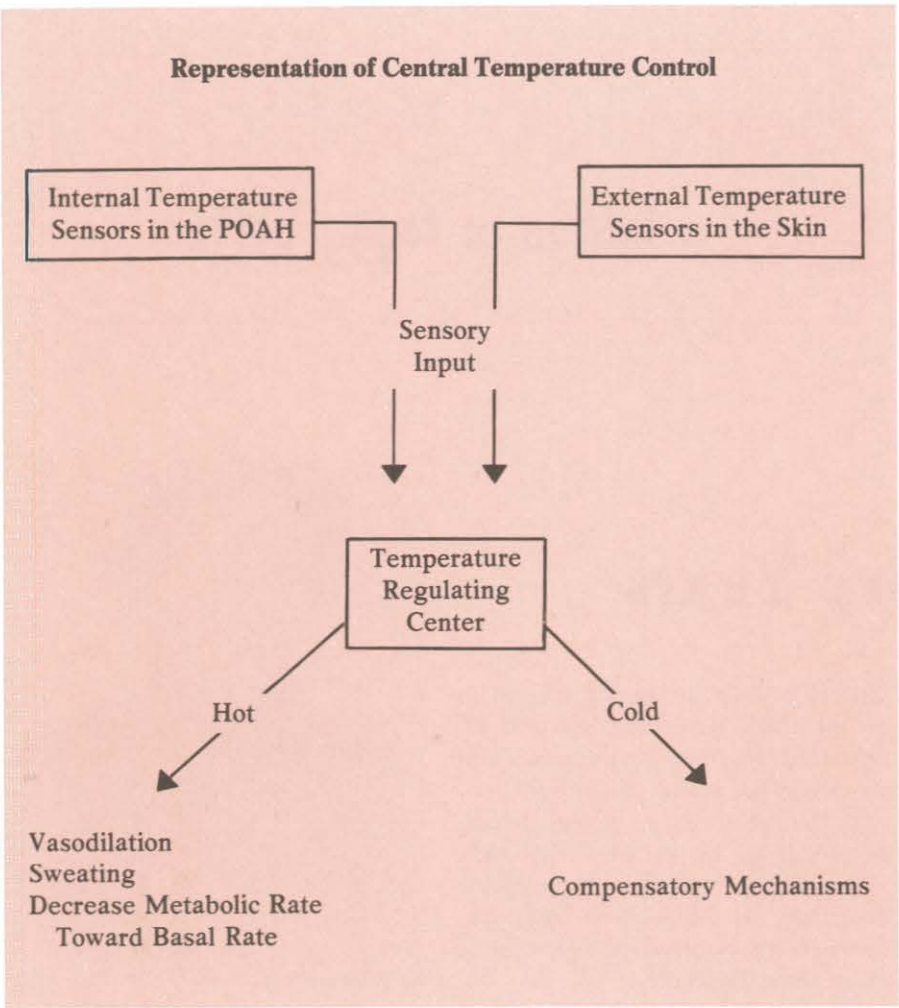
Anecdotally, the male sex hormone, testosterone, can increase the metabolic rate by 10-20 percent, but this effect is insignificant when taken in light of the other more powerful metablic controls.

Direct local effect on cells is a major factor for only those cells in closest proximity to the surface, that is, those cells maximally affected by environmental cold. These cells are the skin, subcutaneous tissue, fat (which already has a low metabolic rate), and structures contained in these superficial layers. These structures include the nerve endings which receive pain and temperature stimulation. If their metabolic rate is severely lowered numbness will result from nonfunctioning of these receptors. One should remember that the lungs are also in direct contact with the environment by virtue of breathing the cold air or gases. This becomes extremely important when one realizes that vasoconstriction to preserve body heat connot occur in the lungs since the entire cardiac output must pass by these cold air channels. The lungs are a major source of heat loss and can be a major avenue for rewarming therapy.

**Heat Loss.** The methods of heat loss are radiation, conduction, evaporation/convection, and conduction/convection. Heat loss by radiation is in the form of infrared heat rays (the same infrared rays detected by night vision devices used in sniping and other night personnel-monitoring operations) given off into the surrounding air. A nude man will lose about 60 percent of his total heat loss by radiation. Every object in his surroundings is also radiating infrared rays proportional to its temperature. Thus, if the temperature of the surrounding objects were greater than the man's, such as in a boiler room or in the hot summer sun, the net effect would be a greater infrared radiation by the surroundings than by the man resulting in the net heat *gain* by the man. So, it works both ways. In diving operations, however, the surrounding chamber atmosphere is rarely hotter than the 98.6°F of man. Heat loss varies directly with the temperature difference between the body and its surroundings. Infrared rays are of a wavelength such that skin color has no effect on the amount of absorption that takes place in contrast to rays in the visible and ultraviolet light ranges, of which 35 percent are reflected by light skin but only a small proportion are reflected by dark skin. Consequently, in sunlight, dark skin does absorb more heat than light skin. Radiation will, of course, play a minor role in the heat loss story of the submerged diver since radiation is primarily operative in air. Radiation effects would be more important in chamber operations and when the diver surfaces.

Conduction is the direct transfer of heat from the body to a cooler object. This mechanism usually contributes little to heat loss since the object (a chair, for example) would rapidly equilibrate with the body and begin to act as an insulator. It is, however, a major mechanism in diving since the cooler object—water—is continually flowing by the unprotected diver and constantly circulating in small amounts through a wet suit. Since the water absorbs body heat approximately 25 times faster than air, one can readily imagine the tremendous heat which can be lost by conduction. The situation with a dry suit is only slightly different since the insulating material is mainly air trapped within the suit and suit material. The body heats the air which then remains in place surrounding the skin to provide insulation. Conduction loss occurs at the interface of the dry suit and the water where some heat from the suit is lost to the water.

If the heated air were not held in place by the suit and were allowed to carry the body's heat away, this would be an example of convection. Convection loss occurs in conjunction with conduction since heat must be conducted to the air surrounding the body before convection can remove it. With no air movement, the heated air immediately surrounding the body would remain there as insulation just as the heated water in the wet suit remains next to the skin for an insulating effect. With air movement, however, the body can lose as much heat as can be delivered to the body surface. Thus the origin of the




wind-chill factor—the faster the air movement, the more potential for heat loss. It is easy to understand why vasoconstriction is so important in maintaining body heat since warm blood would then be kept away from the cooling body surface.

Evaporation/convection is the last mechanism. A small amount of water is constantly being lost from the body surfaces, including the lungs, as water vapor without forming visible water droplets. This water vapor at body temperature is then carried away by convection resulting in about 25 percent of the total heat loss. When the body's thermoreceptive centers sense a net heat buildup, one mechanism for its release is by increasing the amount of heat lost by the evaporation/convection route. This is the origin of sweating. Heat produced by exercise is often released by this method.

**Central Regulation of Body Temperature.** Body temperature is regulated by nervous feedback mechanisms via the temperature regulating center in conjunction with thermal receptors. The main internal temperature sensors are located in the preoptic anterior hypothalamus (POAH), a part of the brain responsible for many of the unconscious mechanisms sustaining life. These sensors signal the temperature regulating center where deviations from the "norm" are detected. Secondarily, there are skin temperature receptors for monitoring external heat and cold sensations. Their signals travel to the POAH via the spinal cord where they also interact with some reflexes which will be discussed later.

The fine line of temperature regulation is maintained by the POAH by increasing the metabolic rate, thereby increasing heat production when sensors indicate a decline in body temperature. Since there is a basal rate at which metabolism must be maintained and below which cellular functioning would be compromised, the main mechanisms for restoration of homeostasis when body temperature is elevated is to increase evaporative loss and increase blood flow to the skin to increase radiant loss.

This heat gain/heat loss balance is finely controlled under normal conditions and requires only minimal regulatory action. Under conditions of extreme stress, however, these mechanisms must be exaggerated and others invoked to maintain homeostasis.

(To be continued)

# Home of BUMED

## a hilltop in foggy bottom

# The Maury Years

*Part two in a continuing series*

**Observatory Hill**

To LT James M. Gilliss, the man who had built the new Observatory, LT Matthew Fontaine Maury did not seem the ideal choice for its new Superintendent. "If it is to be an observatory," wrote Gilliss to a civilian associate, "Maury is not the man to be at its head, unless he has an entirely different taste from that induced by his previous life and labours." (*1*)

Gilliss had good reason for his opinion. Maury's previous interest during his 20-year Navy career leaned heavily toward the study of winds and ocean currents, although he certainly was not without credentials in other fields such as geography and meteorology. He had served three extended tours at sea and had taught himself navigation and astronomy before writing *A New Theoretical and Practical Treatise on Navigation* in 1836, a work that met with instant success.

Setting his preoccupation with oceanography aside for the moment, Maury vigorously launched himself into his new job on the morning of 8 Oct 1844. There was much to be done. The building needed paint, and gutters and downspouts were yet to be installed. New furniture and instruments had to be purchased, and there was the matter of supplies, i.e. coal for the furnace, oilcloth,* carpeting, pens, inkstands, washstands and pitchers, brooms, candlesticks, doormats, oil lamps, and spittoons. The new Superintendent looked after every detail himself.

Maury also supervised the remounting of instruments that had been installed improperly, and on every clear night he could, began mastering each one in turn. And there were many to master: the 9.6-inch equatorial refracting telescope in the dome, and transit instruments, a mural circle, and a prime vertical instrument.

Even the lieutenant's most skeptical critics were impressed by an apparent shift in interest, a shift that occasionally unlocked the emotions of a man moved by the complexity of the celestial order. (*2*)

At the dead hour of the night, when the world is hushed in sleep and all is still; when there is not a sound to be heard save the dead beat escapement of the clock, counting with hollow voice the footsteps of time in his ceaseless round, I turn to the Ephemeris* and find there, by calculation made years ago, that when that clock tells a certain hour, a star which I never saw will be in the field of the telescope for a moment, flit through and then disappear. The instrument is set;—the star mute with eloquence that gathers sublimity from the silence of the night, comes smiling and dancing into the field, and at the instant predicted even to the fraction of a second, it makes its transit and is gone! With emotions too deep for the organs of speech, the heart swells out with unutterable anthems; we then see that there *is* harmony in the heavens above; and though we cannot hear, we feel the "music of the spheres." (*3*)


*LT Matthew F. Maury from a photograph taken in 1853*

*The oilcloth-covered floors in the instrument rooms were never swept but rather wetmopped to prevent dust.

*An astronomical almanac with tables giving the computed positions of a heavenly body for every day of a given period.

Library of Congress

*The port of Georgetown from the top of Observatory Hill about 1850*

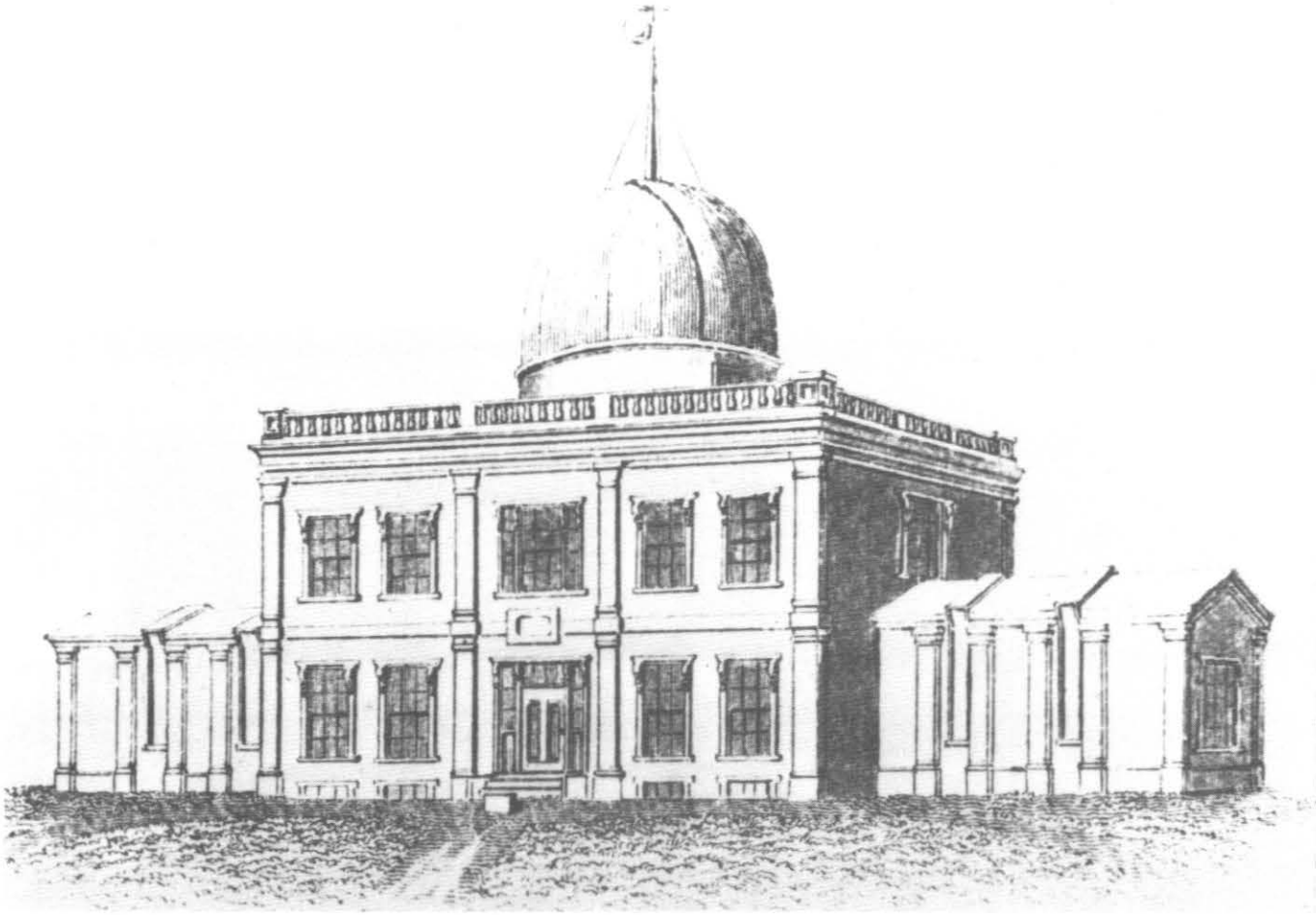
Such musings notwithstanding, the prematurely balding, 38-year-old officer was still a scientist intent on gathering data. He proposed to the Secretary of the Navy a most ambitious project—the cataloging of "every star, cluster, nebula or object that should pass through the field of view."(*4*) The catalog was never finished but some of the observations enabled Sears Walker, one of the Observatory's astronomers, to determine the orbit of the newly discovered planet Neptune.

But the Depot of Charts and Instruments, as the Observatory was still officially called, had other pressing functions to perform such as the purchase and distribution of navigational charts, books, and instruments. "Before a chronometer is purchased here for the Government," wrote Maury, "it is taken on trial for a year, during which time it is carefully compared with a standard clock, that a record may be kept of its performances, which record is required with the utmost nicety, and embraces the hundredth part of a second."(*5*) In November 1847 there were some 60 to 80 chronometers on hand requiring attention as well as thermometers, barometers, and other navigational instruments.(*6*)

The Depot came under the jurisdiction of the newly created Bureau of Ordnance and Hydrography and, as such, Maury saw its mission to include the preparation of wind and current charts "of the three grand oceans, viz: the Atlantic, the Pacific, and Indian."(*7*) The Observatory had a good collection of weather instruments and meteorological observations were performed regularly. In the newly constructed magnetic observatory, scientists studied the earth's magnetic field.* By request of the Secretary of the Navy, a local time service was added in 1845. From a flagstaff mounted on the Observatory's dome, a black canvas time ball 2½ feet in diameter was hoisted each day at 10 minutes before 12. At the instant of noon, an officer in the chronometer room released the ball by means of an electric telegraph key, enabling ships on the river and the local citizens to set their timepieces. With many of these projects proceeding simultaneously, the new institution soon was up to its dome in more work than Maury could handle.

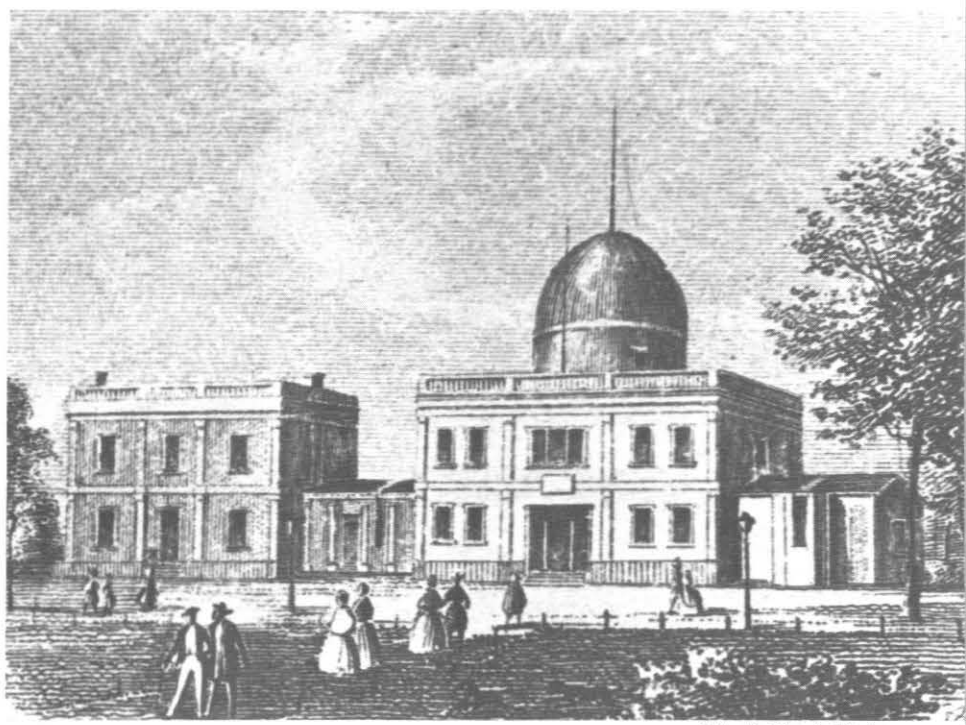
Even as the Observatory opened for business, it had scarcely enough employees to man its instruments. The Secretary of the Navy helped solve the problem by hiring civilian "professors of mathematics" to act as observers. They would make the necessary astronomical sightings and reduce the data to usable reference tables.

*See page 20

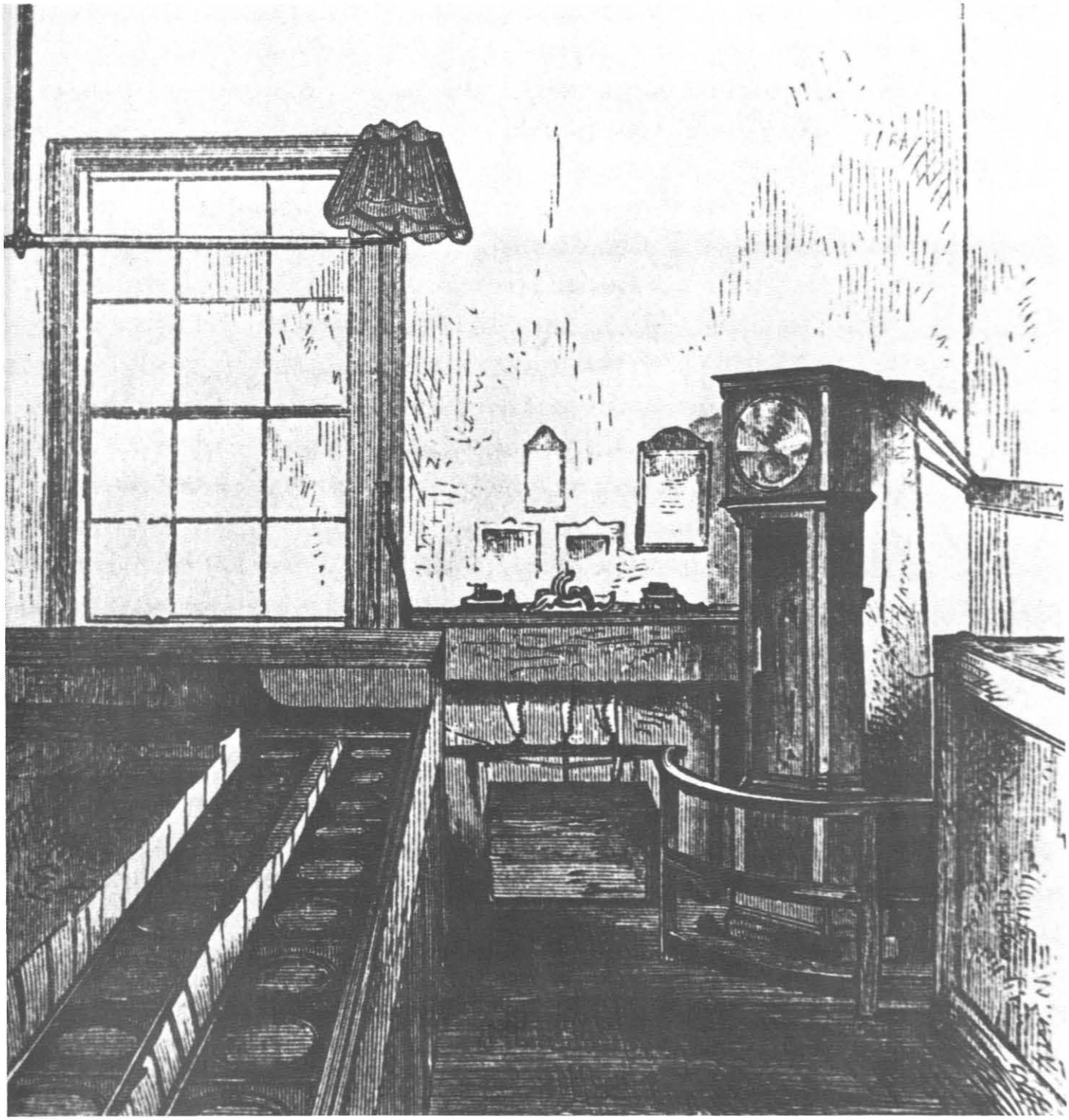


U.S. Naval Observatory

*(Above) For many years, Washington's citizens relied on the Observatory's time ball, shown in this 1845 engraving, to set their watches. (Right) The Observatory and its newly completed Superintendent's residence is depicted in this engraving from about 1850.*



Columbia Historical Society



*The Chronometer Room in the Observatory's east wing*

Selected passed midshipmen from the Naval Academy and junior officers were also assigned to duty. The former were given astronomical and meteorological data to reduce and, occasionally, they took a turn at the instruments. In their off-duty hours, they had access to spare telescopes and transits with which to practice. It was all good experience for the young men who someday would skipper their own vessels.

The Mexican War came and siphoned off many of Maury's officers. Nevertheless, the Superintendent had 21 employees working for him by the end of 1846 and was close to achieving his goal of having at least two competent observers for each instrument "so that when the night is clear there may always be an eye for every telescope in the Observatory." (*8*)

Maury and his colleagues lived "off campus" and commuted a considerable distance each day to what was now being called Observatory Hill. He and his family lived in a rented dwelling not far from the White House, but he longed to build a residence adjoining his new office both for convenience and to entertain the many guests that were coming to see the new scientific showplace.

On 1 April 1845 John Quincy Adams dropped by, but the sky was cloudy and Maury suggested he return another evening when viewing conditions would be better. Three days later, after a hectic day in Congress, the 78-year-old man got his promised look at the nebula in the Orion constellation, ". . . at the cluster of spangles in Auriga, at the double stars, orange and blue, in Andromeda." (*9*) It was truly a memorable evening for the man who had for so long been deprived of his "lighthouse of the sky."

One thing Adams had noted was the absence of suitable quarters and garden for the Superintendent. His influence with the Secretary of the Navy and Maury's pleas finally bore fruit. Several weeks after Adams' second visit, Maury was authorized to seek bids from Washington contractors for the construction of a two-story, slate-roofed house with a basement and a "back building" and "wash house." (*10*) The cost was not to exceed $5,000.* In late 1847 the family moved in, and a year later the Observatory's east wing was extended 24 feet to join the house. Maury could now walk to his office through the connecting structure that soon doubled as a storeroom for chronometers. (*11*)

Some effort had already been made to landscape the grounds by planting trees and laying out walks. An outside observer wrote early in 1846 that the site "will soon afford a delightful place for recreation, being on an eminence, and affording a splendid view of this city, Georgetown, Alexandria, and the District." (*12*) Sometimes Maury would take short respites from his labors and wander about Observatory Hill with his children. It was not all recreation for them; learning flora and fauna and the characteristics of the changing seasons could never begin too early for a scientist's offspring. (*13*)

These seemingly idylic and park-like surroundings did not tell the whole story. Just beneath the Hill's base flowed the Potomac, more sluggish now that its current had been broken by new riverbank businesses like Easby's shipyard. A substantial grass-covered marsh had developed with accompanying summer mosquitoes and humidity. Maury, his family, and the other employees soon began to suffer frequent bouts of fever and chills probably malarial in origin.

The Superintendent himself was stricken periodically and sent his ailing wife and children to the Virginia countryside during the worst of the summer months. By 1855 his disenchantment with the site and the night fogs that severely hampered the observations began showing up in official communications.

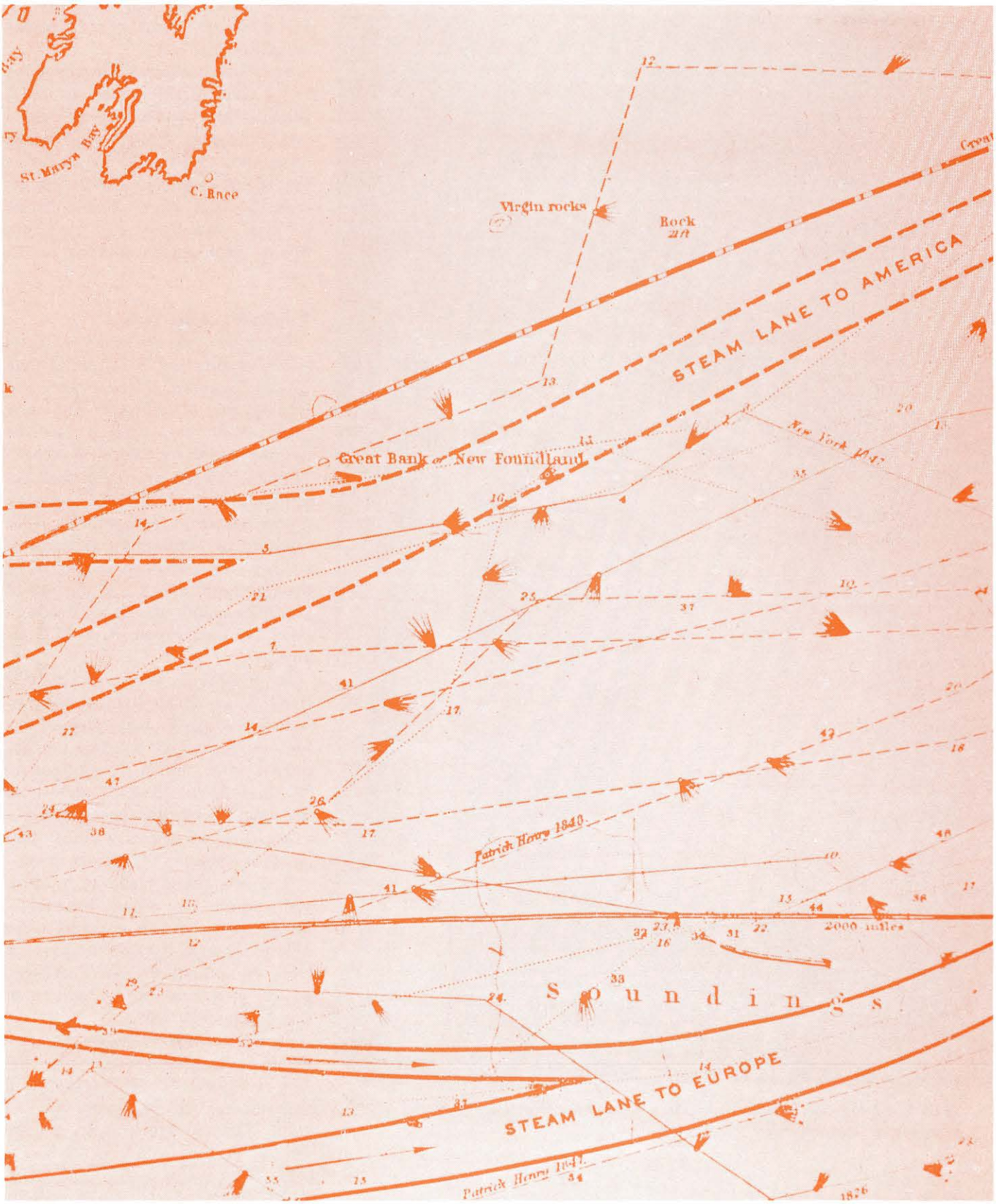
> The observers, the watchmen, and all whose duties expose them to the night air, suffer every summer and fall from the attacks of bilious and intermittant fevers. Those who reside on the grounds are never in any part of the air exempt from these attacks. . . . I am compelled, at much inconvenience, both public and private, to abandon this place for two or three months every year, but seldom do the duties of the office permit me to go until the seeds of disease have taken root . . . I have already been laboring under attacks of fever and ague this summer; and never during the last ten years, has the family been free from the disease and its insidious effects. (*14*)

The problem never resolved itself and eventually got much worse as the river silted and the marsh grew. Maury proposed two solutions: Fill the wetlands or remove the Observatory "beyond the reach of their noxious influences." (*15*)

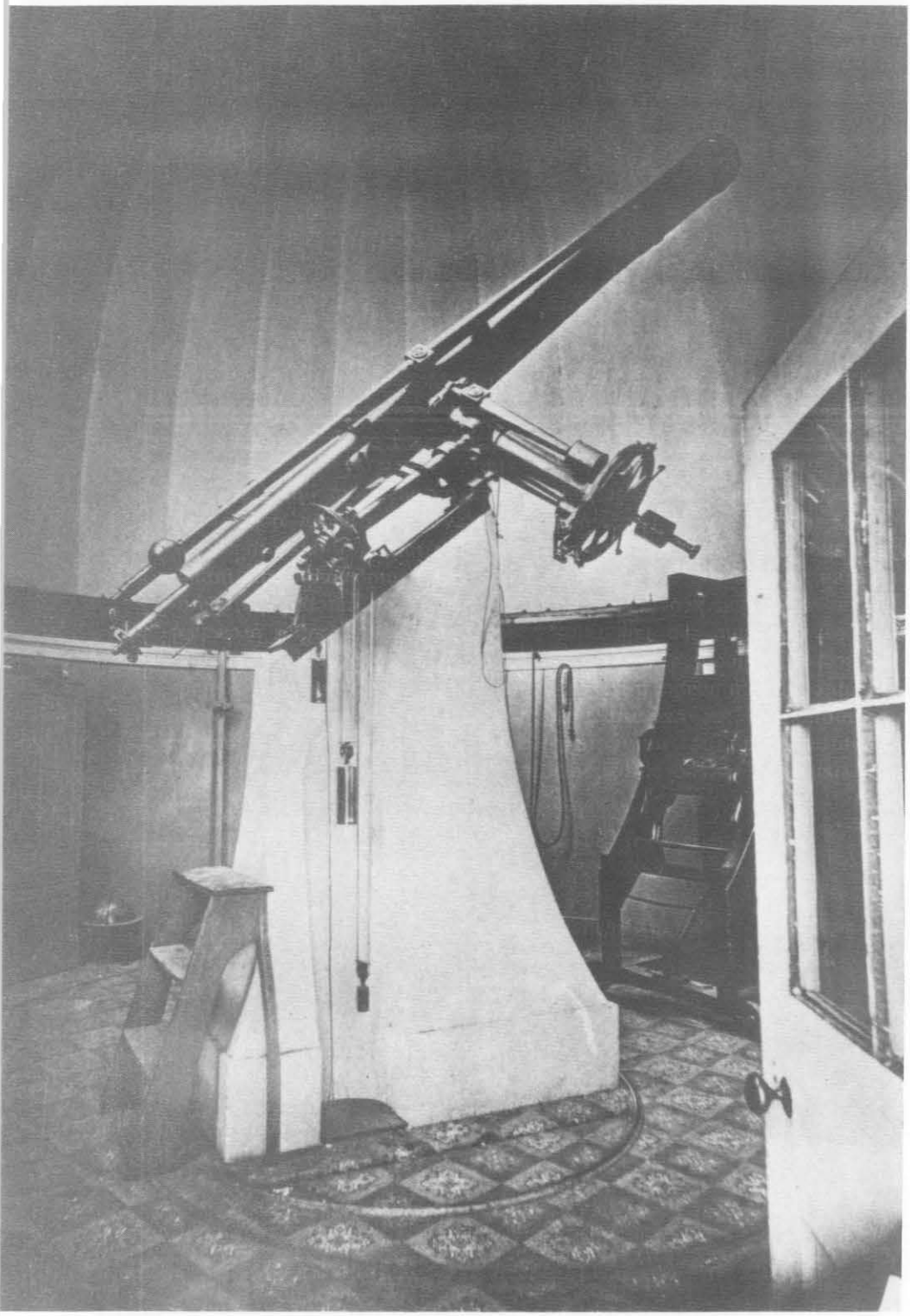
Maury suffered more than relapses of fever. By the 1850s oceanography had largely replaced astronomy at the Observatory. Gilliss' worst fears had been realized. With the exception of James Ferguson's discovery of three new asteroids with the 9.6-inch telescope few other astronomical developments were publicized. The preparation of wind and current charts dominated the work schedule. The star catalog had been abandoned after the reductions of thousands of star observations fell hopelessly be-

*The final cost, as stipulated in the building contract of 12 Feb 1847, was $7,399.

*Portion of Wind and Current Chart No. 6, Series A of the Grand Banks, prepared under Maury's supervision at the U.S. Naval Observatory and Hydrographical Office. The Superintendent devised the brush-tailed symbols to indicate wind speed and direction and variation of wind direction during the day. The heads of the brushes face the wind source and their width represent the degree of variation of wind direction during the day. Numerals represent water current strength.*


St. Mary's Bay
C. Race
Virgin rocks
Rock
STEAM LANE TO AMERICA
Great Bank of Newfoundland
New York Way
Patrick Henry 1846
2000 miles
Soundings
STEAM LANE TO EUROPE
Patrick Henry 1847

U.S. Naval Observatory



*The 9.6-inch Merz and Mahler refractor, housed in the central dome, was the workhorse of the Observatory for many years.*

hind. From 1850-1861 the Observatory produced no further publications on astronomy.

Frictions developed between some of the civilian mathematicians and a skipper they perceived was running a very loose ship. There seemed to be little guidance from the top, as far as the astronomers were concerned. As they became more independently involved with their own research, Maury grew more addicted to his own.

**Pathfinder of the Seas**

On 12 Dec 1854 the Depot of Charts and Instruments officially became the United States Naval Observatory and Hydrographical Office.* The emphasis was, as expected, on the hydrographical. Volumes of oceanographic material were published beginning with the *Abstract Log for the Use of American Navigators* in 1848, followed by eight more volumes of sailing instructions. This work brought much interest on the part of mariners, many of whom offered to record oceanographic data on their voyages.

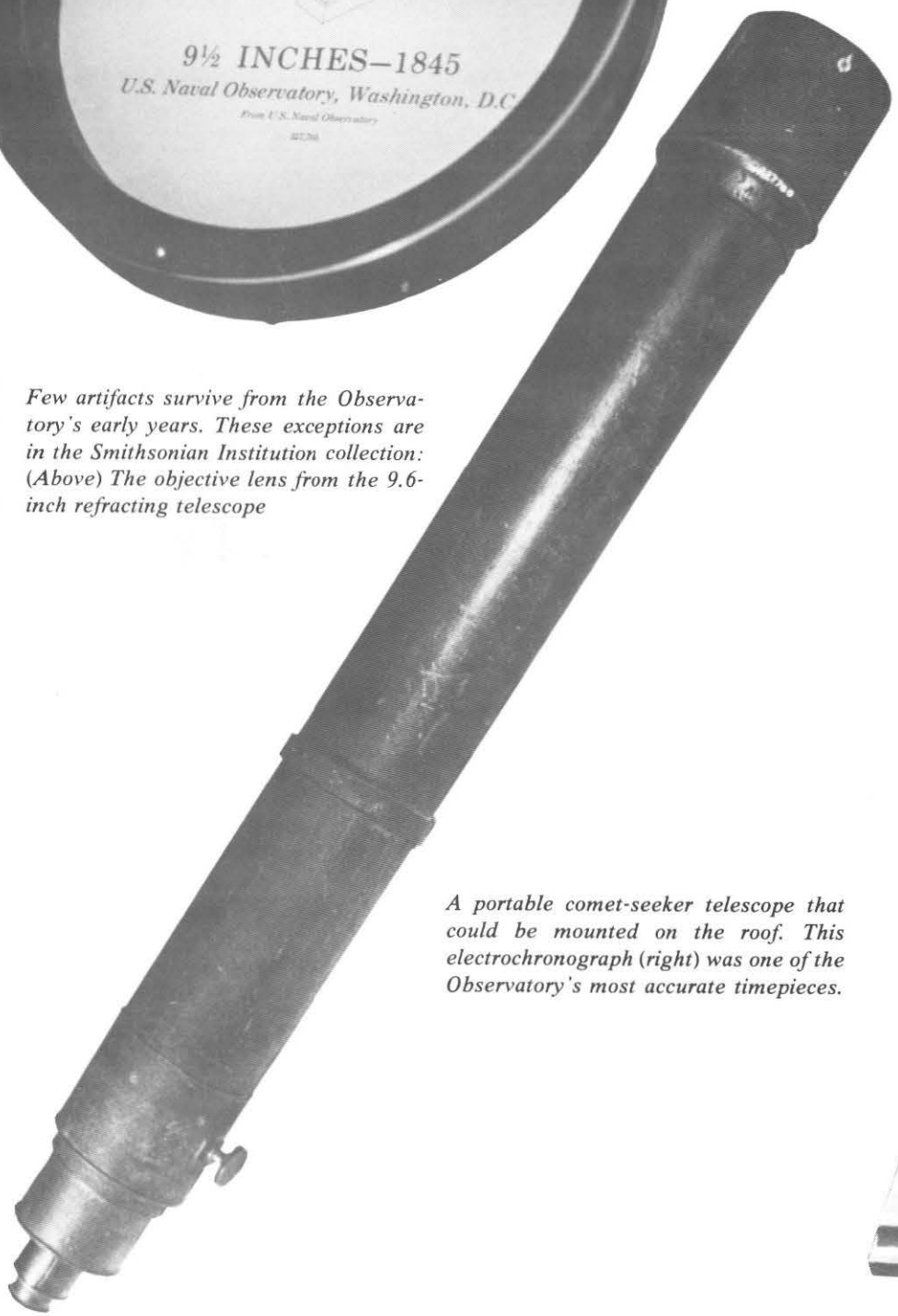
In 1853 Maury left for Brussels as the U.S. representative to an international congress that adopted his uniform system of recording oceanographic data. When he returned to Washington he occupied almost all his time writing and overseeing the processing of the new data that suddenly deluged the Observatory.

The new charts made an immediate impact on ocean commerce. Using them, clipper captains were able to shave 47 days off the passage from New York to San Francisco, resulting in a savings of millions of dollars annually. (*16*)

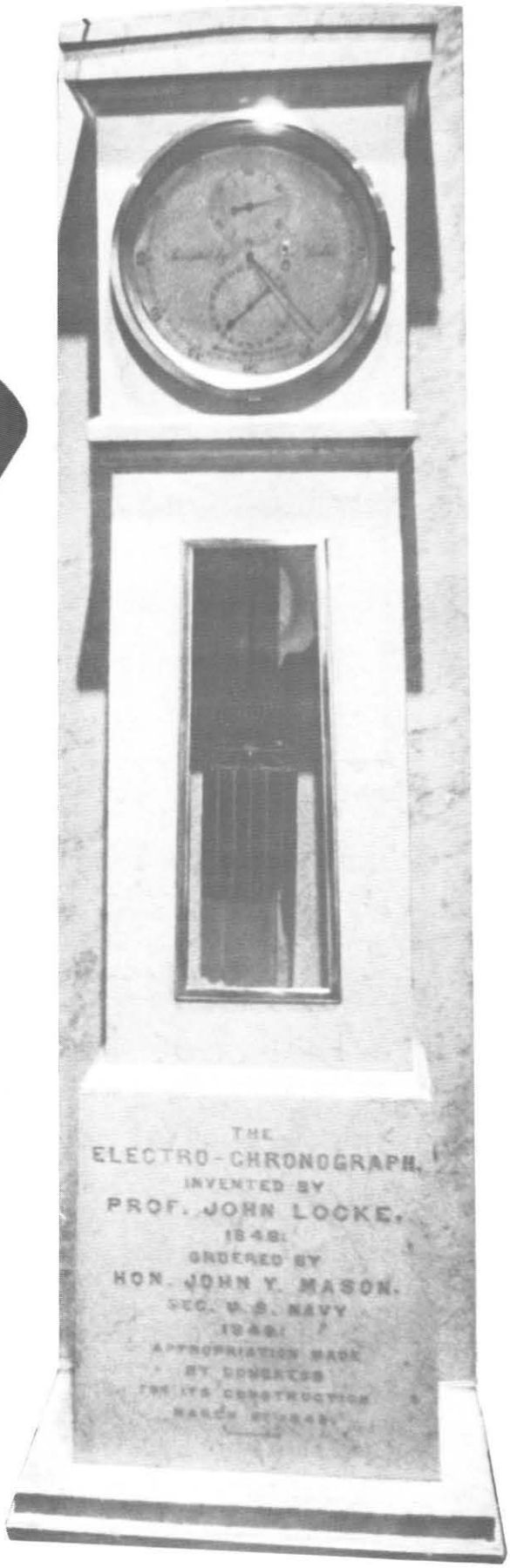
In 1855 Maury published *The Physical Geography of the Sea,* the first textbook of oceanography, a science that had just come into its own. The Superintendent of the

*For the first 10 years of its existence the institution had also been called the National Observatory.

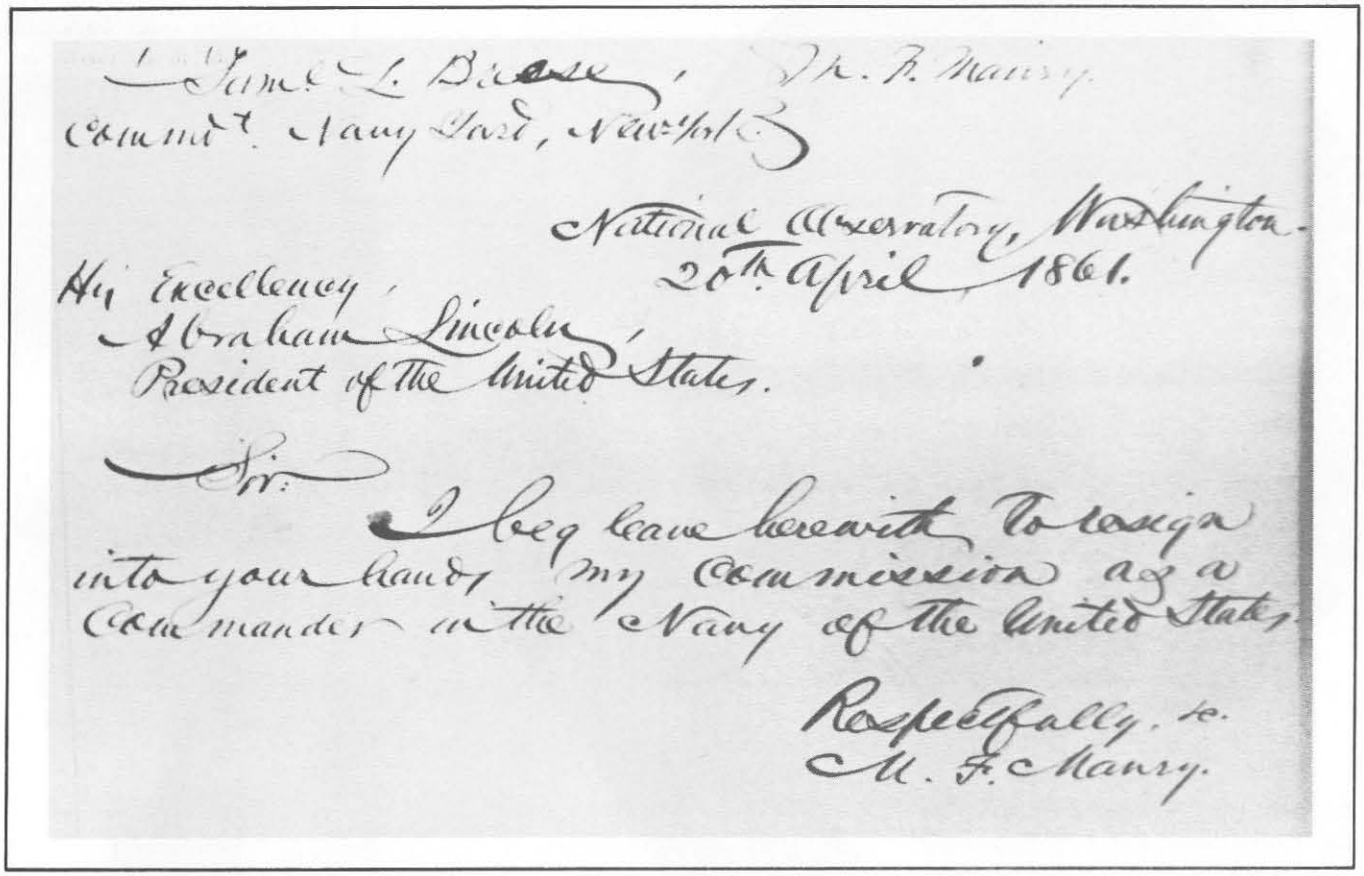

*Few artifacts survive from the Observatory's early years. These exceptions are in the Smithsonian Institution collection: (Above) The objective lens from the 9.6-inch refracting telescope*



*A portable comet-seeker telescope that could be mounted on the roof. This electrochronograph (right) was one of the Observatory's most accurate timepieces.*



National Archives



James L. Breese,
Comm^d. Navy Yard, New York

M. F. Maury.

National Observatory, Washington
20th April 1861.

His Excellency,
Abraham Lincoln,
President of the United States.

Sir:

I beg leave herewith to resign into your hands my Commission as a Commander in the Navy of the United States.

Respectfully, &c.
M. F. Maury.

*The letter that ended Matthew Maury's Navy career*

Observatory and Hydrographical Office was now universally acclaimed as the "Pathfinder of the Seas." He was also a man running in many directions at once. Talk of a trans-Atlantic cable intrigued him and he prepared an undersea profile of the ocean between the United States and Europe. Cyrus Field, the man who later engineered the cable, consulted with Maury frequently.

The Observatory staff was no longer able to tackle the workload effectively and the Superintendent, now more conscious than ever of his neglect of the astronomy, began to request more personnel. In 1858 the staff had seven lieutenants, four professors of mathematics, one assistant astronomer, and one clerk. To the Chief of the Bureau of Hydrography and Ordnance Maury wrote: ". . . I would urge, with the earnestness admissible, the importance of bringing up this back work, and of giving to the Observatory a force sufficient to work up to their capacity the admirable set of astronomical instruments with which it is equipped." (*17*)

The request was too little too late and fell on deaf ears. A year later, Maury's astronomical computers fell from seven to three. "Those who were formerly here are either so broken down in health as to be unable for work, or other duty has been assigned them. (*18*)

As the decade closed and the Observatory passed its 16th birthday, the nation it served also showed signs that it too was broken down in health.

**Choosing Up Sides**

New Year's 1861 opened on what was a very unfinished looking Nation's Capital. The Washington Monument, only a third completed, seemed as though it would remain that way. Cranes and its yet to be installed 9 million-pound cast iron dome littered the grounds of the Capitol. At the other end of the wide and alternately dusty and muddy boulevard called Pennsylvania Avenue, stood the President's House. This southern styled mansion, like the Observatory, less than a mile away, was uncomfortably close to the Potomac and its seasonal hordes of malaria-carrying mosquitoes.

Following the route of present day Constitution Avenue was an open sewer known as the Washington City Canal, a garbage-clogged waterway that had fallen into disuse. When the wind was wrong the fetid odor of decaying offal and dead animals blew equally over the White House and Observatory Hill.

Such appearances aside, there was a somber, foreboding mood that per-

meated Washington that January 1st. How could the Capital be finished in form or spirit when civil war loomed on the horizon? Would the United States see another year as an undivided nation?

It certainly did not seem so as one event piled precipitiously upon another. South Carolina had just seceded in December and its authorities were already seizing federal property. One by one the Southern States were leaving the Union. On 13 April Fort Sumter fell. Two days later President Lincoln called for 75,000 volunteers. The Civil War had begun and with it came uncounted and excruciatingly painful and personal decisions. The time had come to choose up sides. Who would remain loyal to the Union and who would go with his State?

Such a dilemma faced the Observatory's Superintendent. Like COL Robert E. Lee, who paced the floor of his stately mansion across the river, CDR Maury, a Virginian also, was sick at heart, hoping the inevitable would not happen, that his State would not adopt an ordinance of secession. "Civil war is like a conflagration," he wrote to a cousin. "There is no telling when or where it will stop, as long as there is fuel to feed it."(*19*)

On the 19th *The Evening Star* reported that Virginia had indeed seceded. That night was Maury's last at his Observatory. He stayed up late, walking the corridors, alone with his memories. The following day he tied up loose ends, dispatching navigational instruments to the New York Navy Yard, dictating letters, and cleaning out his desk. At 3 p.m. that Saturday afternoon, the Superintendent finished his work and turned over his sword to a fellow officer. He then asked his secretary to take dictation for a letter of resignation, but the distraught man could not bring himself to comply. Maury's daughter later recalled the incident: "[The secretary] presenting the unfinished paper with one hand . . . covered his eyes with the other and exclaimed, with a choking voice and gathering tears, 'I cannot write it, sir!'"(*20*) Maury picked up the pen and himself wrote to his Commander in Chief: "I beg leave herewith to resign into your hands my commission as a Commander in the Navy of the United States."

He then changed into a black broadcloth suit and sadly looked across the Potomac at Arlington Heights in what was now the Confederate States of America. A hack awaited him in the drive outside the Observatory residence. Maury climbed aboard with his belongings. He was leaving behind his sword, his uniform, and an illustrious 36-year career that had seen him become a world renowned scientist. Tears flowed freely and unashamedly down his face as he descended Observatory Hill to 23rd Street for the last time. —JKH

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**(To be continued)**

# The Magnetic Observatory

The Naval Observatory's appearance on Camp Hill coincided with a worldwide interest in terrestrial magnetism. There was a common belief among seafaring nations that an understanding of the Earth's magnetic field could aid navigation. Britain, France, Russia, and several other nations in northern Europe were actually conducting seaborne surveys and establishing fixed magnetic observation stations all over Europe.

By nature, the experiments were international in scope, requiring scientific cooperation on a grand scale. Moreover, any nation worth its scientific salt was compelled to participate.

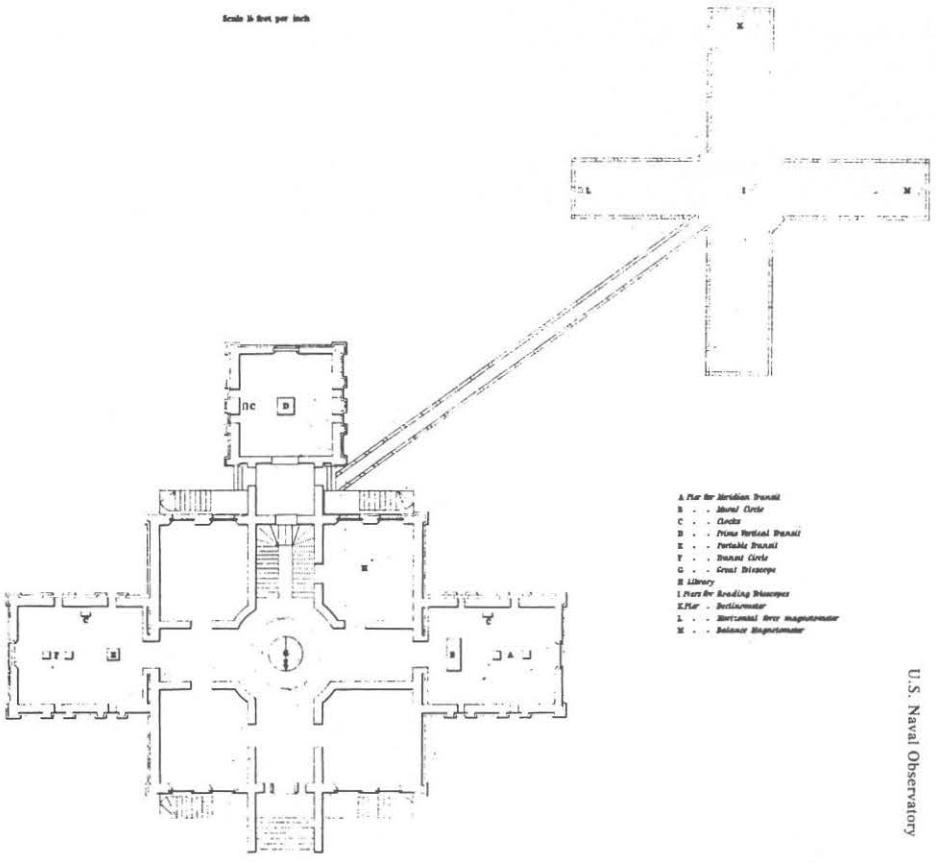
Just starting out in the government sponsored astronomical business, the United States joined the world scientific community. Even as the Naval Observatory's telescope and transit instruments were being mounted and calibrated, an underground room behind the main building was being equipped with sensitive magnetometers to read the Earth's magnetism.

The cross-shaped magnetic observatory and its 52-foot-long stone and brick connecting tunnel were completely subterranean so as to insulate the instruments from outside disturbances. The chamber was 10 feet wide, 10 feet high, some 70 feet long in each direction, and 18 feet beneath ground level. At the cross' intersection was an 8-foot diameter skylight.

The magnetometers sat on stone piers at the extremities of the cross, with the horizontal force magnetometer at the east end. The west end contained the magnetometer to measure vertical force. At the cross' southern foot was the declination magnetometer. The piers in the center of the cross carried scales and reading telescopes so that the magnetometer could be read remotely.

The engineers encountered difficulty from the beginning. Because of cost, they cut corners. In place of stone and brick, they built the room's walls and roof of timber and then backfilled the excavation with earth. On his visit to the Observatory on 1 April 1845, John Quincy Adams spotted the fatal flaw. "[The room] leaks, either from springy ground or from rain. They have been obliged to suspend the observations; and the instruments which are there, if suffered to remain there long, will perish by the dampness of the atmosphere."* Maury had already solicited bids to replace the wood with brick and line the chamber with plaster and slate, but learned the job would cost nearly $3,000.

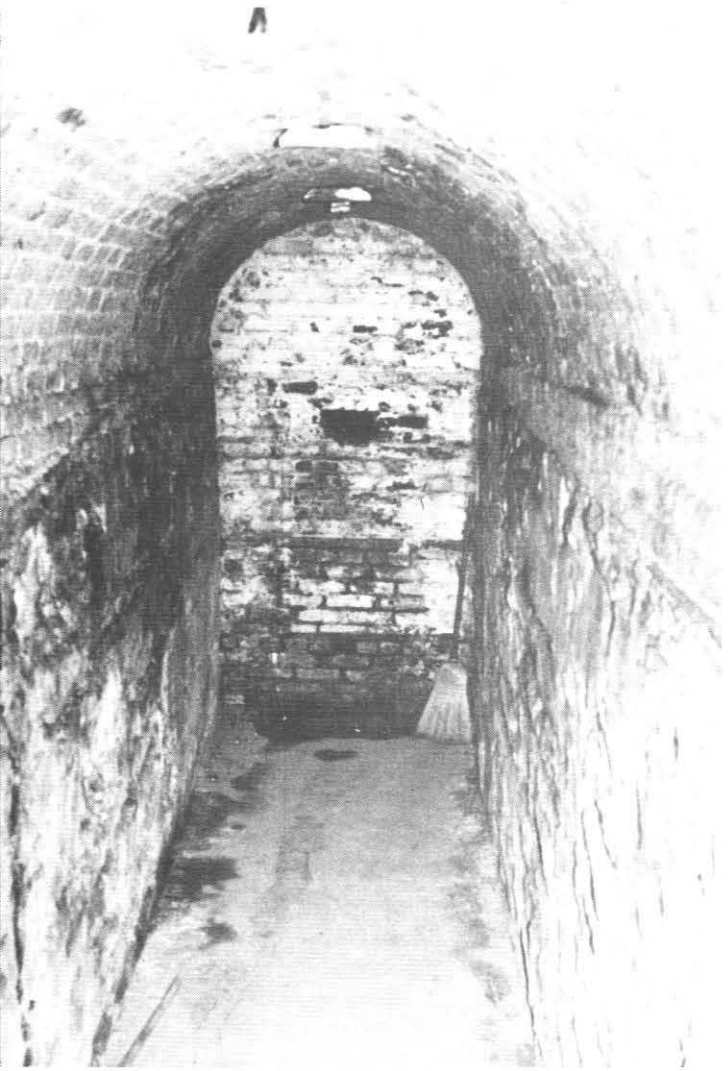
*Adams CF (ed): *Memoirs of John Quincy Adams 1795-1848,* p 189.



U.S. Naval Observatory

*Floor plan of the main building and the cross-shape magnetic observatory and its connecting tunnel*

Photos by HM3 Brian T. Carey



*Portion of the connecting tunnel today shows the brick wall that sealed the magnetic observatory.*

*Rubble fills the tunnel beyond the wall.*

Adams was greatly disturbed. To suspend the magnetic observations for any reason would critically damage the fledgling institution's credibility, especially during the Observatory's first year of operation. The magnetic observatory would have to be waterproofed, the sensitive brass magnetometers cleaned, and put into use. In a meeting with the Secretary of the Navy 10 days after the visit, the outspoken Adams recommended the immediate resumption of the experiments. His intervention made little difference; the flooding persisted, and by the time the fall rains began, water that had percolated through the ceiling was "more than shoe deep" according to LT Maury's recollection. The wood began to decay and a large section of roof gave way.

The Superintendent removed the instruments and sometime since, the access tunnel to the magnetic observatory was sealed.

On 30 Jan 1982 a team of volunteers led by the editor breached the brick seal, entered the chamber, and found some of the tunnel network intact. A project is now underway to remove debris and open the magnetic observatory to study. —JKH

## On Growing Children

# Developmental Stages and Emerging Emotional Disturbance

CDR Eli Breger, MC, USNR

**"Whatever is formed for long duration arises slowly to its maturity." Johnson**

Children grow physically and develop emotionally along predictable patterns and within similar ranges of time. From conception to death the human organism proceeds from stage to stage under the stimulus of inner growth forces. During each stage along the way the child must cope with certain tasks, and with successful mastery of each one, the ability of the individual to adapt is strengthened and future development proceeds. Such is the design of life. It provides the developing child with growth tasks to accomplish and the solutions result in newfound coping mechanisms. These enable him to better master the next stage of development and the inevitable problems which life presents. They also create within him a sense of harmony between his internal needs and demands of his environment. Thus each successful resolution brings forth more strength for future mastery.

At no time is the rate and complexity of growth and the number of stresses demanding adaption as great as during the childhood years. Each stage poses distinctively different issues requiring unique resolutions. In the process of working them through, children may demonstrate distressing behavior out of keeping with their previous pattern. This should be viewed as a temporary sign of imbalance in a struggling youngster. Such disturbed behavior may persist in children having weaker coping skills or being raised in difficult environments.

Let us look at the fundamental developmental stages and the most likely symptoms and disturbances to emerge at each point along the way.

### Within the Uterus

Pregnancy must be considered because of its profound and often lifelong impact on the developing child. One may review pregnancy as a stage designed to accomplish basic physical soundness for the child. For the mother it is a period of preparation helping her to assume her maternal role. At the time of conception the child is endowed with a genetic makeup which affects his later ability to adjust to life.

Many medical conditions have an impact on the developing fetus. For example, metabolic disturbances and infections within the mother can be transmitted to the developing child with the possibility of causing physical deformity, mental retardation, and other neurologic problems. A traumatic delivery may have deep affect on the intellectual and neurologic soundness of the emerging infant.

A mother's attitude toward her pregnancy may significantly affect her acceptance or rejection of her child. Pregnancy often helps her to work through initial negative attitudes and adopt healthier and more productive views. Should this not occur, mother is likely to experience guilt and depression or, through a defense mechanism, banish these unacceptable feelings from her conscience and replace them with a compensatory overprotectiveness toward her child. Similarly, anxious and insecure women may gain confidence during the period of pregnancy. If they remain insecure and anxious while raising their children these feelings may be transmitted to their offspring.

### The Infant

Infancy, corresponding to the period between birth and 18 months of age, is characterized by the child's position of total dependence with his functioning determined by inborn drives or instincts. A rhythmic build-up occurs of internal distress and disquietude requiring feeding and holding for proper relaxation, contentment, and gratification.

Infancy has been psychologically referred to as the "oral stage" because feeding is the mode for transfer

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of security. The nourishing, mothering individual gradually becomes vitally important to the infant and is differentiated from other individuals in his environment. The quality of the nurturent process is important in establishing a sense of security in the child. This involves how the baby is held, how content the mother herself is, and the manner in which she feeds. It follows that imbalances or frank disturbances occurring during this period would manifest themselves in great part through eating difficulties. The infant may refuse to eat, thereby rejecting his mother; he may overeat because of excessive tension; he may ruminate his food (involuntary regurgitating and swallowing) as a means of prolonging the pleasure of the feeding process, or he may persistently eat undesirable and potentially dangerous items in cases where neglect is more flagrant.

While mastery over tension is developing we may find sleep disturbances emerging. This indicates a baby unable to relax and fall off to sleep. Habitual manipulations of the body involving rocking, headbanging, and excessive masturbation become outlets for overly tense infants limited in their ability to establish effective means for discharge. Infants who do not successfully establish deep love ties with their mothers and then turn away from this endeavor often develop problems in relatedness constituting the earliest form of childhood schizophrenia, a major psychiatric disorder.

**Stage of Negativism**

We next arrive at a stage of negativism corresponding to 18 months to 3 years of age. By virtue of his intellectual growth and physical mobility, the child has developed to the point where he is now able to say, "No," and react negatively to socializing demands made on him. Such a demand often centers on toilet training which the child may refuse to do. Negativism and willfulness are characteristic of this stage and do not indicate disturbance. When the child's relationship with his parents is secure, a working through takes place based on a delicate negotiation between parent and child. With successful mastery there is an impressive growth of adaptive ability which opens the way for much maturity and constructive handling of life. If the negativistic struggle is not worked through, temper tantrumlike behavior, refusal to become toilet trained, and breathholding spells all become symptoms which when fixated become the essence of emotional disturbance. The complexity of this stage is further demonstrated by those children who do become trained and socialized without truly wanting to but based on feelings of fear and pressure. An overly perfectionistic, excessively neat, and compulsive personality emerges prone to periodic breakdowns in bowel and behavioral control.

**The Preschool Child**

The preschool child, between the ages of 4 and 6, undergoes significant development of his sense of maleness or femaleness. During this stage children develop strong emotional attractions, akin to sexualized feelings, toward the parent of the opposite sex. They compete with the parent's partner, discover the unworkability of their feelings, and then return to a deeper-than-ever bond of identification with the parent of the same sex. Their sense of masculinity or femininity thus is enhanced. This delicate phase has been referred to as the "oedipal stage." It is hallmarked by anxieties, fears, and sleep disturbances based on the conflict and guilt surrounding the child's rivalrous and sexualized feelings. Understandably, deep lifelong problems of sexual identification, such as homosexuality, appear to have their beginnings in this stage.

**The Elementary School Age Child**

This child has many new demands made upon him to leave home each day, sit still, concentrate, and learn. Most children have grown to a point of readiness but others have not. School brings stresses with it but also immense impetus for further growth. New contacts with peers and teachers broaden the child's opportunities for patterning his personality through identification. The opportunities are many for learning—to think, to develop one's intellect, and to widen one's base of knowledge. From this we can see symptoms or disturbances emerging relating to anxiety about separation from home and family, social interactions, or disorders of learning.

**The Teenager**

Adolescence traditionally ushers in a major disequilibrium within the child's physical, social, and emotional balance. It is a very demanding stage calling for the accomplishment of many tasks such as establishing greater independence from family, firmly refining one's sense of sexual identification, thinking more seriously about vocational choices, and establishing more firmly a personal moral and ethical code. Periods of temporary turbulence reflecting the ungluing of previously tightly knit personality patterns are of course known to every parent. Virtually every area of functioning can be affected including relationships with family and friends, impairments in academic achievement, and breakdowns in socially acceptable behavior. For many adolescents, particularly in today's unsettled world, this disorganization may not settle. It may evolve into a variety of significant lifelong psychiatric illnesses such as antisocial character disorders, manic-depressive illness, and schizophrenia. Fortunately, however, the vast majority of adolescents achieve safe passage to the shore of adulthood, arriving much strengthened and matured.

**"There is no fruit which is not bitter before it is ripe." Publilius Syrus** □

# Model Smoking Cessation Program

Carolyn Cappello, M.A. CDR Christopher K. Holmes, MC, USNR

The first session of a Stop-Smoking Clinic at NRMC San Diego was about to begin. About 20 participants entered the room nervous and apprehensive about what lay before them. Before 2 hours had passed many of the people had committed themselves to quit smoking. They would start to develop the habit of not smoking, the new way for smokers to think about quitting. This is the approach used in the smoking cessation program at NRMC San Diego.

**Smoking Habit**

The smoking habit affects approximately one-third of the American public. However, within the Navy and Marine population 41 percent of military men and women smoke (43 percent men, 20 percent women) in the 25 and younger age group, and in the 25 and older age group, 43 percent smoke (45 percent men, 35 percent women). (*1*) The health-cost impact of this large number of smokers is enormous: added sick days lost from work, medical costs for sick call visits, and, ultimately, increased risk of early disability and/or premature death.

The consequences of smoking affect not only the smoker but every taxpayer. The Federal Government pays an estimated $5 to $8 billion for health care expenses directly related to cigarette smoking and an estimated $12 to $18 billion in lost productivity, wages, and absenteeism caused by smoking-related illness. (*2*)

Carolyn Cappello is Director of the Smoking Cessation Program at NRMC San Diego, CA 92134. Dr. Holmes is Senior Medical Officer at the Naval Training Center, San Diego, CA.

**Risks of Smoking**

Cigarette smoking is considered the largest preventable cause of death in America. Each time a smoker lights up, he starts a physiological response that is very damaging. For example, during smoking the heart rate and blood pressure rise. The more common toxic and noxious components of cigarette smoke are nicotine, tar, and carbon monoxide. Carbon monoxide reduces the capacity of the red blood cells to carry oxygen, and it can remain in the blood stream for hours after a person smokes only one cigarette.

Cigarette smoking is associated with an average increase of 61 percent in the overall death rate over nonsmokers and is considered responsible for 83 percent of lung cancer cases in men. (*3*) The lung cancer rate among women has more than tripled in the last generation, and it is estimated that by mid-1980 lung cancer will surpass breast cancer as the number one cancer killer in women. This appears to be correlated with recent increases in the smoking rate in women, especially young women.

Workers in some occupations are at higher risk than the average if they smoke. Data suggests there may be a synergistic effect between smoking and certain pollutants occurring in the occupational setting, such as uranium, chromium, nickel, and arsenic. People who work with asbestos and also smoke have eight times the lung cancer risk of all other smokers and 92 times the risks of nonsmokers not exposed to asbestos. (*4*)

Other forms of cancer associated with cigarette smoking are cancer of the lip, tongue (and other areas of the mouth), and the larynx. Cancer of the esophagus, urinary bladder, and kidney are also seen more frequently in smokers. Two other important lung diseases strongly linked to cigarette smoking are emphysema and chronic bronchitis.

For those who quite smoking, death rates from lung cancer decrease at a rate roughly proportionate to the number of years since quitting. After 10 to 15 years of not smoking cigarettes, the risks approach those of persons who have never smoked. (*5*) Microscopic examination of lung tissue from cigarette smokers shows progressive cell changes of the type which may precede cancer. The degree of such change increases with the number of cigarettes smoked and is diminished if smoking is discontinued before development of invasive lung cancer. Cessation of smoking also sharply decreases the risk of heart attacks and other circulatory diseases.

**Stop-Smoking Program**

In December 1980 the Environmental Health Service of NRMC San Diego hired a full-time employee to direct its smoking cessation program. Prior to recruiting this director, all smoking cessation efforts had been carried out by volunteer military and civilian personnel, but personnel transfers and reassignments limited the voluntary program's consistency. The new director also brought to the Navy a background in health education and 3½ years experience in smoking cessation programs with the American Cancer Society and San Diego Community College.

Several important components are involved in the program's effort to

reach the large group of smokers who wish to quit. The primary goal is to expand the number of stop-smoking clinics. Several of these have already been conducted at the core hospital. They are open to all active duty and retired military members, their dependents, and civil service employees.

The clinics are usually held monthly. Each clinic lasts 4 weeks and consists of eight 2-hour sessions held twice weekly. It has been found that successful quitters are those who continually examine their smoking behavior, rethink their problems, and work out different solutions to reconcile their failures; gradually they gain self-confidence in their ability to stay off cigarettes. This tremendously important effort of developing the habit of not smoking takes patience, time, and effort.

One of the great rewards of quitting comes when the ex-smoker discovers that using tobacco to change his/her environment is of little value when compared with the security, peace of mind, and sense of achievement that he/she gains from the quitting process. It isn't long before ex-smokers forget all the negative aspects of the quitting experience and are focusing on all the benefits that go along with being a proud ex-smoker. Accomplishing this task is easier when smokers come together in groups to share mutual fears and concerns and provide support and encouragement for each other.

No hard data yet exists, but growing evidence suggests that stop-smoking clinics are most successful when they take place at the worksite, where small groups of workers and their workmates join together in the quitting process. Quit rates are higher and maintenance lasts longer when smokers know each other and already have a feeling of camaraderie, peer support, and even peer pressure.

In the coming months, strong efforts will be directed toward training more leaders to conduct stop-smoking clinics at other worksites (including those aboard ship) in NRMC San Diego's area of responsibility. Two such programs have already been conducted at NRMC Branch Clinic, Naval Air Station, North Island.

New trainees complete a stop-smoking clinic themselves, whether they are ex-smokers or not. This helps them develop empathy for the smokers they will work with. The trainees then meet with the program director individually to discuss the program guidelines and the logistics of setting up their own clinics. Next, a trainee studies the program manual and co-facilitates a clinic with someone who has already conducted one. The trainees will usually go on from there to coordinate and lead clinics at their individual worksites.

**Research, Education, Evaluation**

The Smoking Cessation Program also acts as a referral source for clinicians and other health care providers working in those specialties that care for patients with chronic diseases worsened by smoking, such as asthma, emphysema, other chronic obstructive pulmonary diseases, and cardiovascular disease.

Educating professional colleagues and the general community is also an important component of the Smoking Cessation Program. One-hour slide/tape in-service presentations are available to any group requesting them. As part of this educational thrust, a day-long conference was held on 20 Oct 1981 at the Naval Regional Medical Center. The conference, entitled "Smoking, Smoking-Related Diseases and Stop-Smoking Methods," focused on the hazards of cigarette smoking to the pulmonary and cardiovascular system and on those added risks of disease incurred by smokers in certain occupational settings. Various stop-smoking methods were reviewed along with the program at NRMC San Diego.

Statistical evaluation of the smoking-cessation clinics is another necessary part of the program. It has been demonstrated that for an average group of smokers joining a stop-smoking clinic, 40 percent or more will quit smoking when measured at the end of the program. Sometimes a clinic participant who had not quit by the end of a program will go on to quit on their own during the first year after the program.

Of particular interest are data showing how many clinic participants who quit smoking initially are still off cigarettes at the end of 1 year. Most programs of this type report rates of about 30 percent. Since our program is new, the data only reflect the first 3 months evaluation of quitters. For this group, the quit rate is 30 percent, although the numbers are still too small for statistical stability.

Research participation on smoking cessation methods is planned for the future. A great many professionals who work with smokers are continually seeking methods that work best in assisting smokers to quit and what follows is necessary to keep people off cigarettes once they have quit. There are, of course, a great many unanswered questions regarding the whole smoking phenomenon. Seeking the answers is one of the powerful forces behind NRMC San Diego's program.

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# Surgical Procedure for Painful Punctate Foot Clavus

LCDR Ronald A. Warcholak, MSC, USN

Punctate foot clavus is a callous-like lesion on the sole of the foot that may cause a great deal of pain and make walking difficult. Patients frequently state that even at rest the lesion may throb, especially if they have been on their feet for any length of time just prior to resting. Most present with one single punctate clavus, although some may have several punctate clavi on the sole of one or both feet. Infantry personnel whose feet contain one or more of these callous-like lesions function with a great deal of pain and at less than optimum proficiency.

Clinical examination reveals the superficial area to be about the size of an eraser head (Figure 1). If the superficial covering is removed a much smaller, round, concave, crystalline clear or yellowish clavus is uncovered (Figure 2). The lesions are very concentric in appearance. Further examination reveals them to be particularly sensitive to direct digital pressure.

Punctate clavi are found on the plantar aspect of the foot, most commonly in the heel region or in the midfoot and forefoot areas. They do not occur under bony prominences such as the metatarsal heads or on the side of the great toe over the distal interphalangeal joint.

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One must differentiate punctate clavi from intractable plantar keratomas (I.P.K.s), plantar verrucae, and helomata miliare. I.P.K.s are found under bony prominences such as metatarsal heads, formed as a result of bony pressure on the under surface of the skin on the sole of the foot. Plantar verrucae, which have a viral origin, interrupt the normal configuration of the skin, contain capillary tufts, and tend to be more sensitive to a squeezing pressure rather than direct digital pressure. Plantar warts bleed very easily when cut. Helomata miliare or seed corns resemble tiny sesame seeds and tend to appear in numbers rather than as single isolated entities.

On biopsy, pathologists tend to describe the punctate clavus as an umbilicated circular lesion measuring commonly from 0.2-0.4 cm in diameter. It may be yellowish in color or crystalline clear. On the microscopic level the lesion is characterized by extensive hyperkeratosis and moderate acanthosis. Acrosyringium is identified in the center of the hyperkeratosis where it is the thickest. This area tends to show loss of the granular layer but without coronoid lamellae. The dermis underlying the clavus may contain a slight perivascular lymphohistiocytic infiltrate.

At present the specific etiology of the punctate clavus has not been determined. It is thought, however, that excessive pressure is the primary cause for their developing on the sole of the foot.

Various treatments have been tried in the past with little success. Intralesional injections of vitamin A, salicyclic acid preparations, and other miscellaneous topicants have not proved successful. Surgical procedures such as currettement, subdermal adhesiotomy, or excising the lesion with two semielleptical incisions have done little to prevent their reoccurrence, and, in fact, have at times made the clavus even more painful due to the accompanying scar formation that results from the surgical procedure.

### Recommended Plastic Surgical Technique

This procedure can best be described as an advancement sliding graft technique. This plastic technique is used by plastic surgeons on other parts of the body for other entities and was first introduced to the author as a practical procedure by a civilian podiatrist.

Optimum results can be expected on the plantar aspect of the foot if the surgeon carefully choses the area to perform the advancement sliding graft to eliminate the punctate clavus. This plastic technique works best where the papillary skin lines or Langer's lines run in a transverse or oblique fashion across the bottom of

Photos by HM1 Gary Silk

*FIGURE 1*

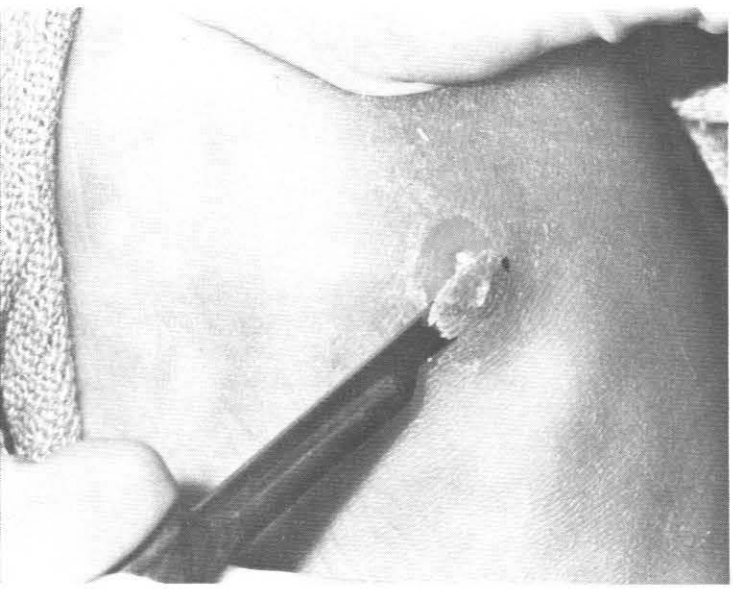

*FIGURE 2*

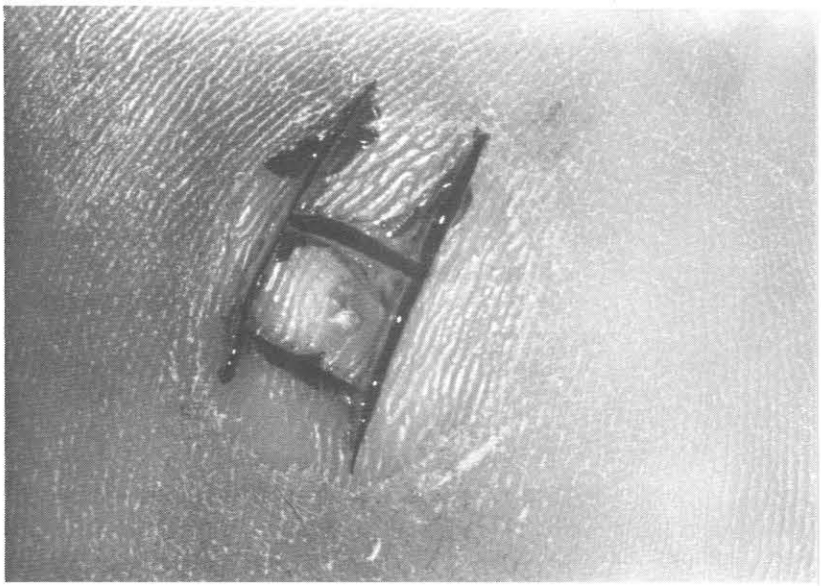

*FIGURE 3*

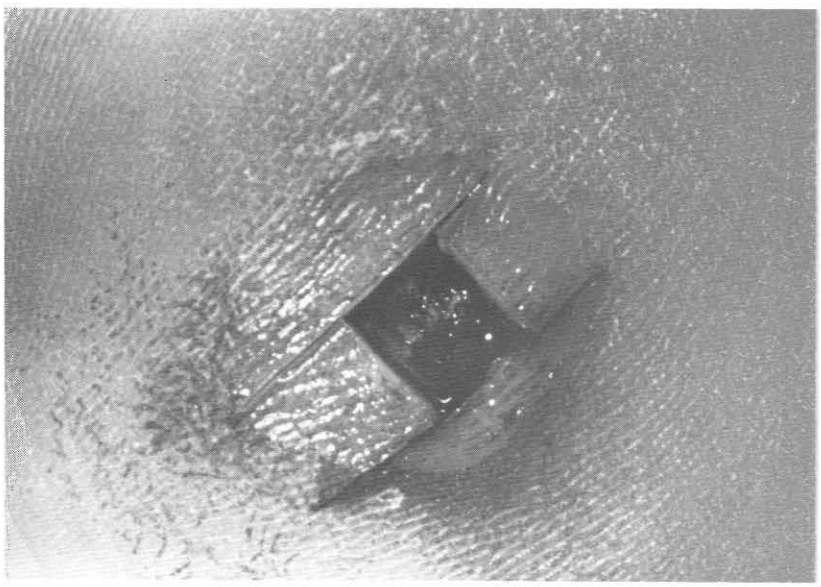

*FIGURE 4*

the foot. These areas are located in the heel and midfoot regions on the sole of the foot. The papillary lines run in a more whirled pattern on the distal one-third on the plantar surface of the foot; an advancement sliding graft technique should not be performed in this area.

**Procedure**

1. The foot to be operated on is prepped and draped in the usual and customary manner.

2. A local anesthetic is infiltrated about the lesion. We customarily use 2 cc of 2 percent lidocaine with 1:100,000 epinephrine. The usual syringe used is a 3 cc syringe to which is attached a 1½ inch 27 gauge needle.

3. The superficial skin covering the clavus is removed with a #15 blade. This clearly delineates the punctate clavus (Figure 2).

4. Two transverse incisions are made in the furrow groove between Langer's lines encompassing the lesion (Figure 3). The length of these incisions vary from 1.5-2.0 cm.

5. Two perpendicular incisions are made connecting the two transverse incisions and again enclosing the lesion (Figure 3). Plastic surgeons advise that a dimensional rule of 1:1.5 be followed in making skin flaps. The length of the flap should not exceed the width of the flap or vice versa by more than a 1:1.5 ratio. This insures good vascularity of the flap.

6. The enclosed rectangular fragment of skin containing the punctate

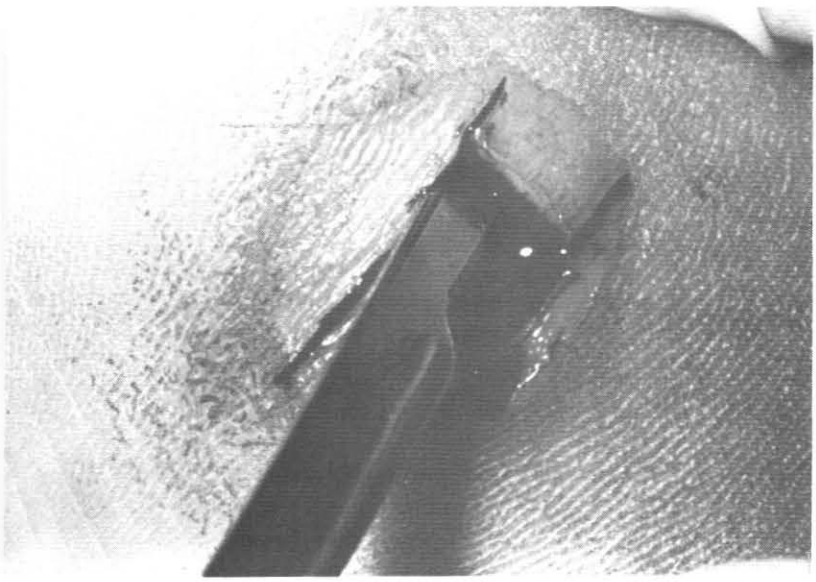

*FIGURE 5*

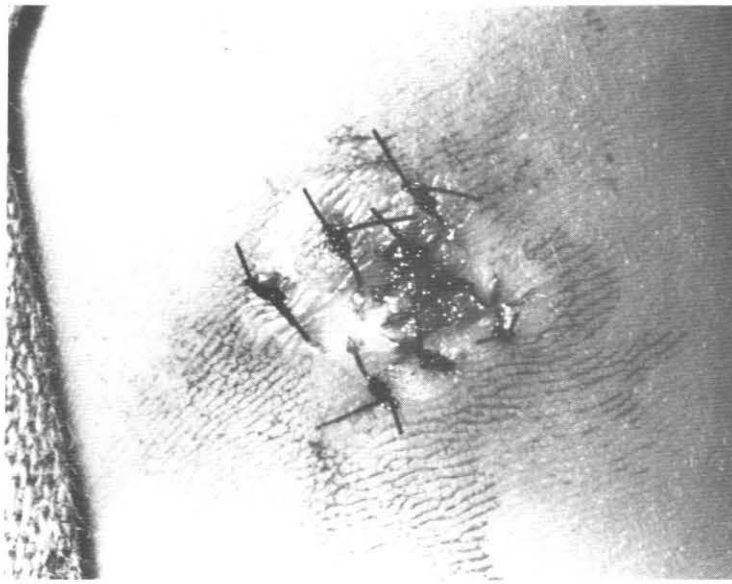

*FIGURE 7*

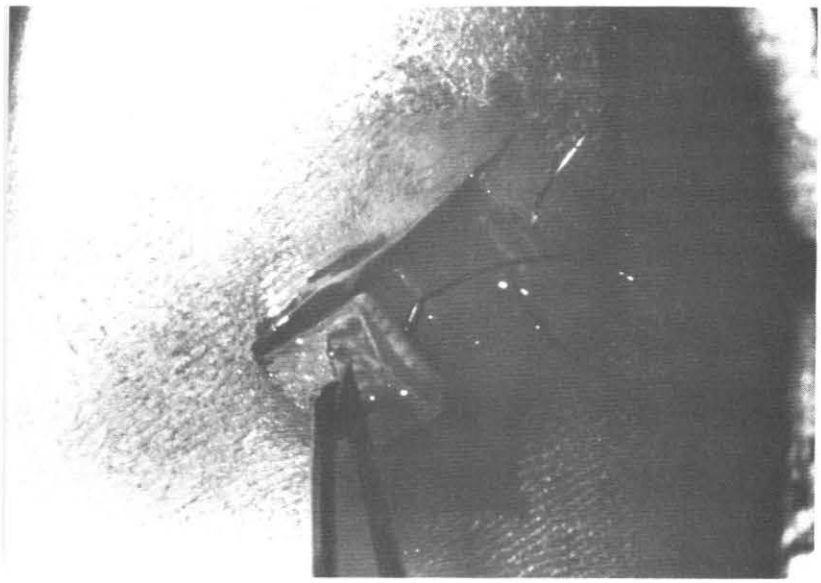

*FIGURE 6*

*FIGURE 8*

clavus is excised including the dermis (Figure 4).

7. Both opposing flap edges are underscored (Figure 5). The flap to be advanced the greater distance is underscored the most. The surgeon should at this point consider where he wants to position the scar. He should plan for the scar to be in the least weight-bearing area on the sole of the foot.

8. Skin closure is accomplished by first approximating the opposing flap edges, followed by closure of the transverse incisions. A total of 10 simple interrupted 4.0 or 5.0 nylon sutures are customarily used (Figures 6 and 7).

9. The wound is dressed with a nonadherent wound dressing followed by a bulky bandage.

10. The patient is allowed to weight-bear on the affected foot in a rigid postoperative shoe. Some surgeons might prefer to have the patient nonweight-bearing to insure primary wound healing with minimal scar formation. The sutures are removed in 3 weeks.

11. Figure 8 is a 30-day postoperative picture of the healed advancement sliding graft site.

**Conclusion**

This paper has presented a plastic surgical technique particularly suited to eliminate and prevent recurrence of the painful punctate foot clavus commonly found on the sole of the foot. To date I have used this sliding advancement graft on approximately 15 patients and have been very gratified with the results, experiencing no postoperative complications and no recurrence of the original lesion. □

## GENERAL SURGICAL RESIDENCY

There is a vacancy in the general surgical residency (PGY-2 level) at NRMC Portsmouth beginning August 1982.

All qualified, interested individuals should contact the Educational Programs Department, Naval Health Sciences Education and Training Command, Bethesda, MD, or CAPT Gregory H. Cross, MC, USN, Chief, Surgical Service, Box 8606, Naval Regional Medical Center, Portsmouth, VA, telephone (804) 398-5460.

## FLIGHT SURGEON WANTED

The Navy Flight Demonstration Squadron will need a flight surgeon beginning in January 1983.

For information write: Navy Flight Demonstration Squadron, Blue Angels, NAS Pensacola, FL 32508 or call LCDR Wand or LCDR Boor, Autovon: 922-2583, Commercial: (904) 452-2583.

## SERVICE COLLEGE NOMINATIONS FOR MSC OFFICERS

Screenings for service college selection board nominations will begin April 1982. Medical Service Corps officers in the below year groups are eligible for consideration for the indicated programs.

| Service College | Course Length | Grade | Eligible Year Groups |
|---|---|---|---|
| Marine Corps Command & Staff Quantico, VA | 10 mos. | LCDR | 69-74 |
| Naval War College Command & Staff Newport, RI | 10 mos. | LCDR | 69-74 |
| Armed Forces Staff College Norfolk, VA | 6 mos. | LCDR | 69-74 |
| Industrial College of the Armed Forces Washington, DC | 10 mos. | CDR | 63-68 |
| Marine Corps Amphibious Warfare Quantico, VA | 10 mos. | LT | 76-78 |

Actual selection for service college is a distinction afforded only to superior officers following a rigorous selection board process. Interested officers are encouraged to reflect their desire for service college assignment on the "Remarks" section of their officer preference card.

For more detailed information call LCDR Knight, Autovon: 225-9004.

## CONFERENCE ON SEXUAL VICTIMIZATION OF CHILDREN

The Child Protection Center/Special Unit (CPC/SU) and the Office of Child Health Advocacy of Children's Hospital National Medical Center will sponsor the Second National Conference on Sexual Victimization of Children. The conference will be held 6-8 May 1982 at Stouffer's National Center Hotel, Arlington, VA.

The purpose of the conference is to bring together health care, social service, mental health, and law enforcement professionals who are currently working in programs designed to meet the needs of sexually abused children and their families. Conference participants will have an opportunity to learn about the newest treatment modalities, the latest research findings, and innovative methods of program development and funding. Since cases of child sexual abuse pose both health and legal problems, the conference will emphasize cooperation among the various disciplines and agencies involved.

The registration fee will be $90. For further information write: Mrs. Nathania A. Miles, Program Coordinator, Children's Hospital National Medical Center, 111 Michigan Ave., Washington, DC 20010 or call (202) 745-5682.

## IN MEMORIAM

LCDR *Edward F.M. Krzanowski,* MC, USNR, and his immediate family died 13 Jan 1982 in an Air Florida jetliner crash in Washington, DC.

Born 14 March 1945, LCDR Krzanowski received his B.S. degree in biology from Georgetown University in 1967, a Ph.D. in pharmacology from the University of Tennessee in 1973, and his M.D. degree from the University of Tennessee College of Medicine in 1976. He joined the Navy in 1973, was a member of the Armed Forces Health Professions Scholarship Program, and from 1976 to 1979, served his first assignment at NRMC Camp Pendleton, CA. At the time of his death, Dr. Krzanowski was stationed at the Naval Hospital, Patuxent River, MD.


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